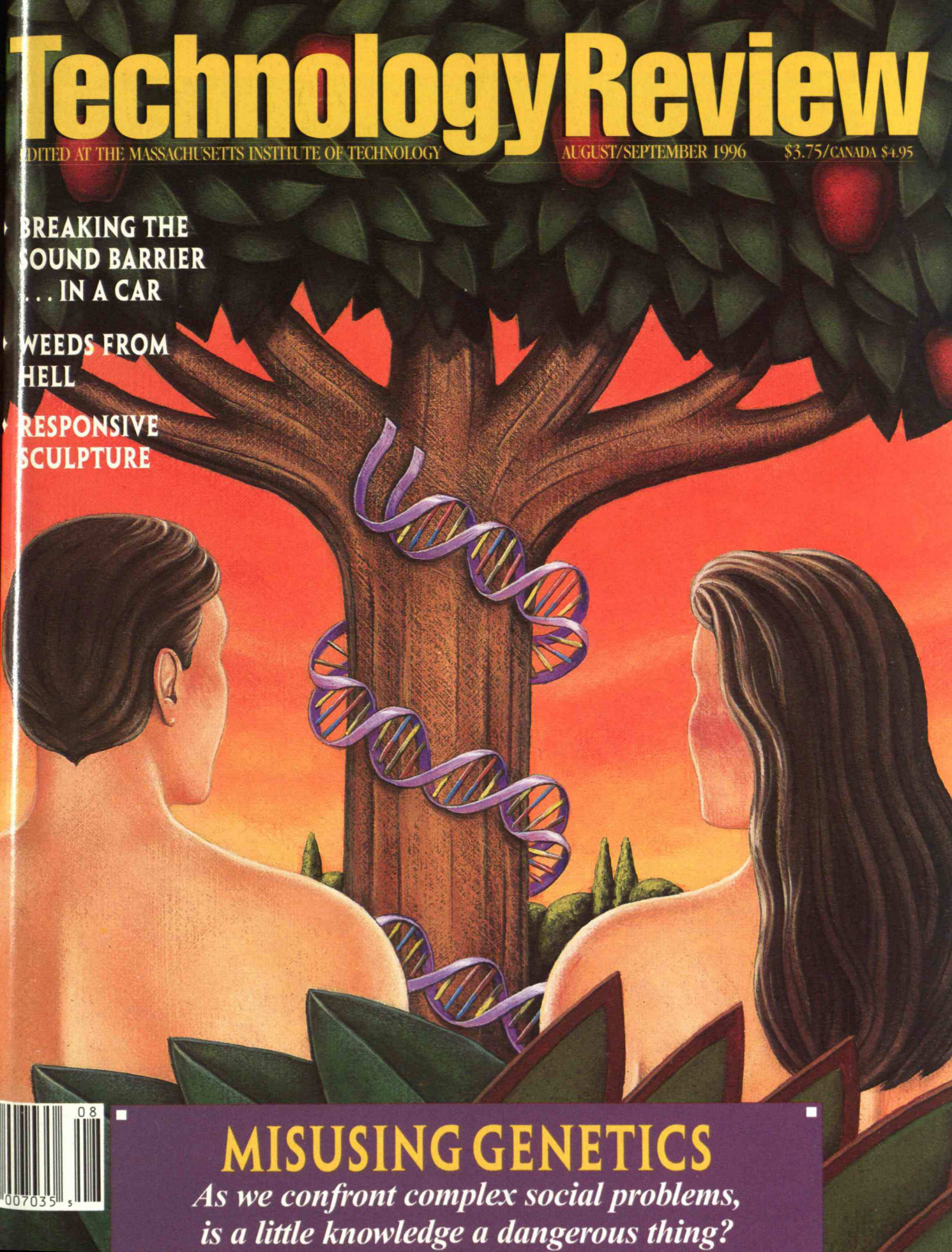


Technology Review

The background of the cover is a stylized illustration. A large tree with a thick brown trunk and green leaves is the central element. A purple DNA double helix is wrapped around the trunk. In the foreground, the backs of two people are shown: a man on the left with short dark hair and a woman on the right with long dark hair. They are looking towards the tree. The sky is a warm orange-red color. The title 'Technology Review' is at the top in large yellow letters. Below it, on the left, is 'EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY'. On the right are the dates 'AUGUST/SEPTEMBER 1996' and the price '\$3.75/CANADA \$4.95'. On the far left, there are three lines of text: 'BREAKING THE SOUND BARRIER... IN A CAR', 'WEEDS FROM HELL', and 'RESPONSIVE SCULPTURE'. At the bottom, there is a purple box containing the title 'MISUSING GENETICS' and a subtitle in italics. A barcode is in the bottom left corner.

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BREAKING THE
SOUND BARRIER
... IN A CAR

WEEDS FROM
HELL

RESPONSIVE
SCULPTURE



08

MISUSING GENETICS

*As we confront complex social problems,
is a little knowledge a dangerous thing?*

technology review

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Matt Ryan and design staff on roof of Red Oak House, Dublin, Ireland.

In 1995, LG's annual sales grew 40% to over US\$64 billion.



It's nice to meet you.

It's Matt Ryan's job to listen.

As a Senior Designer at LG Electronics Design-Tech, Matt must intimately understand the different aesthetics of each European country. And then translate that understanding into intelligently designed TVs, VCRs, microwaves and other products. (Matt and his colleagues even helped design their company's Red Oak House headquarters.)

At LG, we listen a lot to our customers. We think that habit explains why our sales grew 40% last year. And why we're already leaders in advanced electronic applications like thin-film transistor liquid crystal displays, high-definition TV, and exciting multimedia areas like computers and video-on-demand.

We're also active in fast-growing areas of business such as DRAM memory chips, genetic engineering, pharmaceuticals, satellite communications, and much more.

But we don't believe our size makes us interesting. We think people like Matt Ryan and his fellow designers make us interesting, because the same dedication and customer focus they bring to their work, our 126,000 other employees bring to our other areas of expertise.

Now, how can we help you?



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Nazi Germany's campaign to remove "hereditarily defective" and "unproductive" citizens had a less virulent but equally misguided U.S. counterpart: social policies designed to "improve" the nation's genetic stock. Will comparable economic hardships, plus a renewed but simplistic faith in genetic science, combine to lead us down a similar path today?



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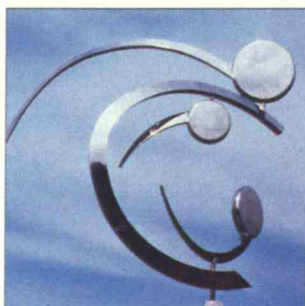
BY DAVID TENENBAUM

Like unwelcome houseguests, non-indigenous plants are making life miserable in numerous habitats by crowding out other species. Prompt action is needed to stave off further encroachments and rebuild the biodiversity essential to ecological health and scenic beauty.

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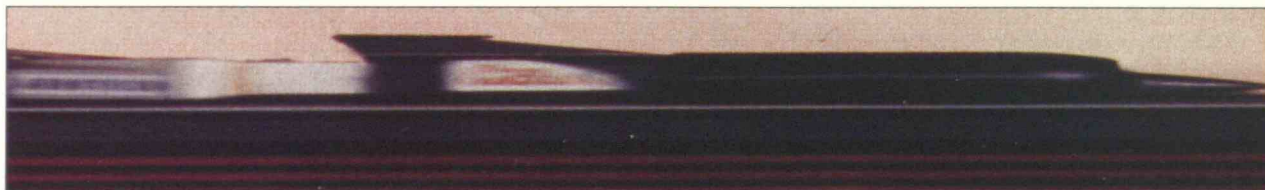
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56 BREAKING THE SOUND BARRIER...IN A CAR

BY MARK FISCHETTI

Two of the world's foremost race drivers—London's Richard Noble and California's Craig Breedlove—will face off this September in an audacious attempt not only to break Noble's land speed record of 633 mph but also to surpass the speed of sound. Noble is relying on sophisticated computer-aided techniques to design his jet-powered vehicle, while Breedlove's approach is seat-of-the-pants. Which of the markedly different cars will carry the day?

COVER: MARC BURCKHARDT



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Technology Review (ISSN 0040-1692), Reg. U.S. Patent Office, is published eight times each year (January, February/March, April, May/June, July, August/September, October, and November/December) by the Association of Alumni and Alumnae of the Massachusetts Institute of Technology. Entire contents ©1996. The editors seek diverse views, and authors' opinions do not represent the official policies of their institutions or those of MIT. We welcome letters to the editor. Please address them to Letters Editor, c/o address below or by e-mail to: <technology-review-letters@mit.edu>.

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You have to take the good with the bad. Or, the Lord giveth and the Lord taketh away. Or, it's the best of times and the worst of times. Whatever homily one chooses, the irony is still terrible, and painful: just as we at *Technology Review* were rejoicing the arrival of R. Bruce Journey, our new publisher, we began mourning the loss of Peter D. Gellatly, our longtime, esteemed, and beloved associate publisher.

Peter died on May 18, 1996, just a few weeks after his lung cancer

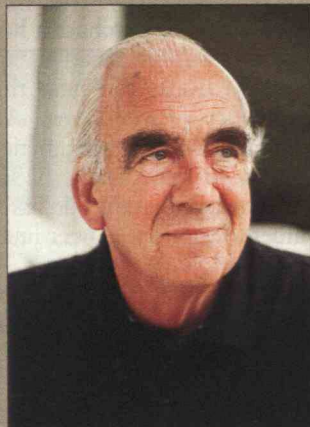
was diagnosed. And while we were shocked by the rapid succession of events and staggered by the trauma of it all, we try to console ourselves in that his suffering was brief and his passing peaceful.

Peter devoted his career to the business side of magazines. With years of experience as an advertising executive for *Newsweek* and the *Saturday Evening Post*, and later as an independent marketing consultant in magazine publishing, Peter brought a business professionalism and commercial savvy to *Technology Review* in 1978 that the magazine previously lacked. Over the next 18 years his sophistication in financial matters and coolness under fire were major factors in the magazine's

First Line

A BUSINESS MAN AND A GENTLEMAN

Peter D. Gellatly
1928–1996



growth. The put-up-the-money confidence in the magazine's marketplace potential recently expressed by our owners is due in great part to Peter's quietly competent efforts to keep the enterprise on track and aimed at the big leagues.

But Peter was an enormous asset to *Technology Review* not only as a professional; his decency, thoughtfulness, and easygoing style helped create a collegial atmosphere we've all come to cherish. He was warm and compassionate, charming and dignified, a gentleman to the core.

His practical, down-to-earth ap-

proach instilled immediate and enduring trust. And his fatherly authority and nurturing was a source of security to each of us in a notoriously insecure business.

We at *Technology Review* like to think of the group as a family. But there was also a large and delightful family to whom Peter was literally father, grandfather, and husband. He is survived by his wife, Constance (Wigmore) Gellatly, five children, six stepchildren, and sixteen grandchildren.

We will all miss Peter very much. But we will treasure the legacies of his wonderful contributions at work and at home, in matters both professional and personal.

—THE TECHNOLOGY REVIEW STAFF

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Letters

FIELDS OF DREAMS

Thank you for not only providing an excellent overview of the research conducted on electric power lines and their effect on human health in "Apocalypse Not" (*TR April 1996*) by Jon Palfreman, but also for featuring the article on the cover.

While seeking to purchase a home in Arizona, a realtor warned us against moving to a house too near the Salt River Project power lines. After I informed her that electromagnetic fields (EMFs) pose no known risk, she said her customers believe that they do and property values around the power lines subsequently are lower!

The real shame is that other environmental factors have adverse health effects. But as the article's conclusion pointed out, the safe political position will be to fund more pointless studies on electromagnetic radiation and thus soak up the precious little funding available for more worthwhile studies.

GREGORY OLSEN
Tempe, Ariz.

I just turned 70. One great thing about living longer is the perspective it provides on history. In the 1930s, I remember reading claims that EMFs had special healing and curative powers. Decades later, EMFs were blamed for causing cancer. What a difference half a century can make!

Today we know that both views are wrong. The interesting thing is what these episodes tell us about ourselves: generally upbeat on technology then, downbeat now.

HOMER B. TILTON
Pima Community College
Tucson, Ariz.

As an engineer working on electric power, I enjoyed Palfreman's research into magnetic fields and was reminded that everything in life has tradeoffs. Palfreman discusses the actuarial statistics of busing students away from power lines. Just getting on and off the bus—leaving aside the risks of traveling in it—is more dangerous than living near power lines.

In 1991, I represented the Institute of Electrical and Electronics Engineers Energy Policy Committee on a cable TV panel discussion entitled "Cheap, Clean Energy—Are You Kidding?" My copanelists included a representative from the local electric utility and two representatives from the Pennsylvania Energy Commission. When asked about the dangers of electric blankets, I observed that the alleged danger from magnetic fields was less than the mental anguish of worrying about the fields. If the blanket's warmth lets you sleep, turn on the blanket. If you are concerned enough about the blanket that you can't sleep, turn it off.

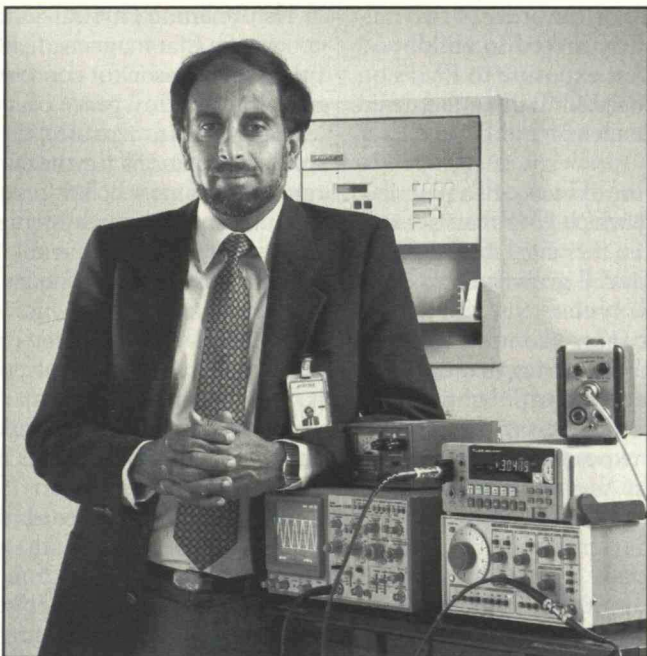
MARK LIVELY
Gaithersburg, Md.

Palfreman claims that scientific research has yielded "no convincing evidence that magnetic fields produced by electric power lines cause adverse health effects." In so stating, he dismisses 50 epidemiological studies of the power-line health hazard that have appeared in peer-reviewed medical literature without accurately reporting their findings.

Readers who tap into the database of the National Library of Medicine in Bethesda, Md., will find that nine of the eleven childhood residential studies of the power-line hazard that have been conducted since 1979 show that children who live in homes close to high-voltage or high-current power lines giving off strong magnetic fields develop leukemia more often than children who do not live in such homes. Six of the eleven studies show that children living near power lines develop brain cancer more often than other children. The cancer ratios in the nine positive studies show that the risk of malignancy among children more heavily exposed to power lines is two to three times greater than that of less-exposed children. The *American Journal of Epidemiology* published five of these studies while the *British Medical Journal* printed two.

Thirty of the forty occupational studies available in the National Library of

Engineering Reflections:



Shiraz Daya in one of Bose's ten listening rooms.

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"There are no set limits. If you see a new challenge, or you want to do something new, you have the freedom to try."

The Engineer: Shiraz Daya, Program Manager, System Products Development, BSEE, Massachusetts Institute of Technology

Date Hired: February, 1974
(rehired, August, 1986)

Last Position: "I actually began my career at Bose. After six years, I wanted to become involved with state of the art electronics outside the audio field. So, I went to an instrumentation company. Eventually, I began a business with a few other people. While things did not work out as I would have liked, it did give me experience in all the aspects of business. That I enjoyed greatly."

The Goal: "As my business began to lose momentum, I talked to friends who were still at Bose. They asked me to consult here, which gave me a chance to see how things had changed. Having helped to run a business, I wanted to keep working in all areas of the business process. As I consulted, I saw such opportunities were available at Bose."

The Result: "Since I was rehired, I've been involved in new product development, working with everyone from engineers to marketing staff. Even now, I'm encouraged to stretch, grow, accept new responsibilities, even if they're outside my job description. In fact, that's how all engineers are treated here. Innovation is actively supported. There's little formality, no rigid hierarchy or pecking order. It's very entrepreneurial. Plus, there's an incredible breadth and depth of knowledge, so I'm always learning. My mind stays open."

For more information on opportunities at Bose, please write, in confidence, to Paul McKinley, Director, Engineering Operations, Bose Corporation, The Mountain, Framingham, MA 01701-9168.

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Medicine show that workers exposed to electromagnetic fields (EMFs) on the job—power and telephone line repairers, cable splicers, electricians, electrical engineers, and electric railway workers—experience a statistically significant increased risk of developing leukemia, brain cancer, and other malignancies compared with less-exposed workers. Almost all these studies have been published in leading medical journals, including the *American Journal of Epidemiology*, the *New England Journal of Medicine*, the *Lancet*, and the *American Journal of Industrial Medicine*. Thus, a clear preponderance of the peer-reviewed epidemiological evidence indicts EMFs as a cause or promoter of cancer.

Palfreman declares that a 1994 study of Canadian workers “found a small association with leukemia.” In fact, this study of 223,000 electric-utility workers showed that those with greater-than-average cumulative exposure to EMFs were more than three times more likely to develop acute myeloid leukemia than their less-exposed colleagues. Moreover, in a group of 31,503 Ontario Hydro workers who were followed after retirement, those workers with greater-than-average cumulative exposure were found to develop acute myeloid leukemia at a rate almost 38 times greater than their less-exposed colleagues.

The author then refers to “another study by David Savitz and his colleagues at the University of North Carolina [that] found no link with leukemia but a small association with brain cancer.” Actually, a Savitz study of 138,905 men employed by five U.S. power companies found more than twice the risk of leukemia in electricians with more than 20 years’ work and nearly twice the risk of brain cancer among all workers with 5–20 years of employment.

Palfreman fails to provide the findings of an 11-member committee of the National Council on Radiation Protection (NCRP), whose unanimous con-

clusions received prominent attention in the August 18, 1995, issue of *Science*. Upon examining the same studies that Palfreman did, the committee declared that exposure to power-line magnetic fields on the order of two milligauss is clearly linked to childhood cancer, and that exposure to EMFs on the job is associated with an increased incidence of leukemia and brain cancer in adults.

Regarding the existence of a plausible mechanism by which EMFs can cause or promote cancer, they cited studies showing changes in cell growth-related enzymes that are “consistent with actions of chemical cancer promoters.” They also cited studies showing that the natural defense response of T-lymphocytes taken from the immune systems of mice is reduced by exposure to extra-low frequency EMFs. As a result, they recommended that:

“1. New day-care centers, schools, and playgrounds should not be built where ambient 60 Hz magnetic fields exceed two milligauss.

“2. New housing should not be built under existing high-voltage transmission lines or in such close proximity to these lines that measured ambient field levels would exceed two milligauss for periods longer than two hours daily.

“3. New transmission and distribution lines should not be built in locations where they would produce fields exceeding two milligauss in existing housing.”

PAUL BRODEUR
North Truro, Mass.

Brodeur, a staff writer for the New Yorker, is the author of two books—Currents of Death and The Great Power Line Cover Up—on the alleged effects of EMFs.

The correlations between elevated exposure to EMFs and adverse health effects may be just “statistical noise.” However, the links might also be screams barely discernible in a cacophony of multifaceted epidemics of degenerative diseases. Thus, it is absurd—no, irresponsible—for Palfreman to suggest that we close the book on this matter.

The American Physical Society’s 1995 conclusion that magnetic fields pose no risk is scant reason for comfort. It would be helpful for my peace of mind, or at least grudging acceptance, if there were solid explanations for the current high rates of ailments like cancers and immune and nervous system disorders. The honest admit much is unknown, and something is amiss. Technocrats typically claim such patterns are in no way related to pollution, be it magnetic or chemical or synergistic. Unfortunately, their denial is rarely accompanied by an alternative explanation. So they have failed to convince me that technology has no remaining hidden edges.

While the 1992 Swedish study that linked power lines with childhood leukemia was accused of “multiple comparisons fallacy,” I do not believe this renders the study invalid. In light of the study’s conclusion, Sweden has implemented major reductions in exposure guidelines for workplaces involving specific products such as computers.

If Palfreman were to decide policy, all such “phantom” risks would be discounted. Technology must remain on trial to ensure its safest and most judicial use.

LEIF JOSLYN
Arcata, Calif.

As an architect, I counsel planners, designers, and administrators to consider and compensate for the possible risk of exposure to EMFs. In the future, it may be acceptably proven that a causal EMF-cancer link does not exist. I would then most happily apologize to those prudent plan-

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ners who took precautions to avoid EMF exposure. But isn't this preferable to not taking precautions and then finding an otherwise unexplainable high incidence of cancer among our clients?

ALAN M. LEVITT
Fresh Meadows, N.Y.

INDUSTRIAL ECOLOGY

As Nicholas Gertler and John R. Ehrenfeld point out in "A Down-to-Earth Approach to Clean Production" (*TR February/March 1996*), the technology network at Kalundborg, Denmark, is not novel. What makes it rare is the extent of the symbiosis and the diversity of the industries involved. The authors suggest that similar networks in the United States could be successful and provide a few examples. Their analysis could be made more dramatic with some simple calculations. Each year, 19 quadrillion BTUs escape power plants in the United States as waste heat. This is 30 percent of the total domestic energy demand. If even only a few percent of this energy could be recovered, the impact would be great. And, consider that less than 10 percent of the metals in hazardous waste streams (with a value of several billion dollars per year) are recovered, even though a colleague and I estimated that more than 90 percent could be retrieved.

If such economic opportunities exist, why are they not being pursued? To the authors' list of regulatory barriers, subsidies for raw materials, and scarcity of market facilitators, I add the impediment of imperfect information. Much of the waste generated annually in the United States is poorly characterized. A thorough understanding of the composition and flow rates of the exchanged materials allows the system at Kalundborg to work. Similar networks are unlikely to develop in the United States until the composition of waste streams receives as much attention as that of primary products.

With negligible transportation costs, the colocated factories at Kalundborg encourage the use of low-grade heat and

relatively low-value materials. Many more valuable waste streams could profitably be transported to symbiotic facilities. The United States should therefore promote not only eco-industrial parks, but also distributed networks of industrial facilities operating symbiotically.

DAVID ALLEN
Henry Beckman Professor in Chemical Engineering
University of Texas at Austin

THINKING BIG ON NANOTECHNOLOGY

Robert J. Crawford's review of *NANO, the Emerging Science of Nanotechnology* by Ed Regis (*TR May/June 1996*) was a patronizing critique rather than a review. Perhaps Regis did express several screwball ideas—but which human being has not indulged in fantasy? Expressions such as "techie cult" and "techno-utopist rhetoric" betray Crawford's contempt for those who dream impractical dreams. A scientist who is so focused on hard facts that he cannot dream will find himself in a tunnel with no light at the end.

JIM COMSTOCK
Brookshire, Tex.

Crawford's review reminded me of the MIT nanotechnology study group meetings I attended in the mid-1980s. As a chemistry graduate student, I hoped to find like-minded students discussing realistic solutions to practical problems such as the molecular structure of nanomachines. Instead, I found a bunch of computer scientists spouting naive political and economic predictions such as "There will be no capitalism or communism in the future—nanotechnology will make them obsolete." The attendees were convinced that they had to prevent the U.S. Department of Defense from developing "nanospies" that could keep tabs on our every move. It's a shame that Eric Drexler and his followers have continued to merely talk about nanotechnology rather than actually doing something to encourage its development.

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SHEDDING LIGHT ON THE NANOWORLD



The tiny spheres of semiconductor material known as nanocrystallites seem designed to prove the adage "good things come in small packages."

How small? Between 1 and 10 nanometers in diameter—encompassing tens of molecules to a few thousand molecules per sphere. How good? So good that they are opening up a window on a whole new realm of physics and chemistry. In a decade or so of creating and probing the submicroscopic particles, chemists have learned that nanocrystallites exhibit unique electronic and optical properties, and that these properties vary greatly

with the size of the particles.

What has eluded most researchers is a way to produce nanocrystallites in sizes that are uniform enough to allow careful study. But Moungi Bawendi, a professor of chemistry at MIT, has developed a technique to create spheres that are consistent in diameter to within a few percent. He can now alter the properties of the spheres simply by adjusting their size. Such control, he believes, could eventually lead to useful new materials and devices.

Nanocrystallites inhabit a murky realm of matter between the molecular level and the bulk level. At this scale, the electrons in semiconductor particles are arranged in discrete energy bands, giving rise to an esoteric phenomenon called quantum confinement: when energy such as light stimulates an electron within a nanocrystallite to enter a higher energy band, the electron cannot escape to the surface of the sphere. It remains trapped inside, where it releases a photon of light.

This "photolumines-

cent" effect is one of the properties Bawendi can control. The spacing of the energy bands—and hence the wavelength, or color, of the light emitted by a nanocrystallite—depends on the particle's size. So by varying the size of the spheres, Bawendi can vary the color of the light they emit. Vividly illustrating this point, Bawendi recently produced different batches of a single semiconductor material—cadmium selenide—with particle sizes ranging from 1 nanometer to 8 nanometers. He then suspended each different-sized batch in a liquid and illuminated it with ultraviolet light. Each batch glowed a different color; the tiniest spheres emitted blue light, the largest emitted red, and the others filled out the spectrum in between.

As with individual atoms, the spacing of energy bands also governs important properties such as electrical conductivity or resistivity. So the person who can control this variable in nanocrystallites has almost godlike power (or "flexibility," as Bawendi more modestly puts it) to create particles that act like new elements. "If you're working with atoms," Bawendi says, "you have only the elements of the periodic table to choose from—you take what's given to you. But

by changing the size of the material, or changing from one type of semiconductor to another, you can 'tune' the electronic structure in an almost continuous way."

Growing Crystals

To create particles of uniform size, Bawendi begins with two compounds, one containing cadmium and the other selenium. When injected into a hot solvent, the compounds decompose and the cadmium and selenium atoms come together to form little crystalline "seeds" of cadmium selenide. Like the nucleus of a snowflake,

the seeds grow by accumulating layers of atoms at a predictable rate. "That process is fairly linear," says Bawendi. "You can keep a fairly constant size distribution as they grow."

Because spheres of cadmium selenide respond to light differently depending on their size, the growth process is easy to track. "We can see the color of the solutions change as the particles grow, and we can calibrate ourselves," Bawendi says. "When the color is orange, say, we can stop right there, because we know exactly what we have. We get instant feedback."

To prevent the newly formed spheres from sticking together, Bawendi uses a technique that has become standard practice in growing nanocrystallites: covering the spheres with an insulating organic molecule. "It's kind of like putting a plastic bag around each particle," he says.

But the particular organic molecules Bawendi has selected—alkylphosphine oxides—are a fortuitous choice. They happen to solve a problem that has plagued research in his field for years: the surfaces of the nanocrystallites tend to be marred by defects that interfere with the behavior of electrons and prevent the spheres from emitting light. Alkylphosphine "plugs up the holes" on the surface, says Bawendi. "The electrons don't find little traps to fall into."

With surface blemishes cleared up, Bawendi and co-workers have discovered that nanocrystallites can act as phosphors: they emit light when stimulated by an electron beam. "A year ago, before we fixed the surface defects, I would have said these things couldn't possibly be phosphors," Bawendi notes. "We just couldn't see any light coming out. But now they shine at room temperature."

UNDER ULTRAVIOLET LIGHT, DIFFERENT-SIZED NANOCRYSTALLITES IN SUSPENSION GLOW DIFFERENT COLORS, RANGING FROM BLUE (1 NANOMETER) TO RED (8 NANOMETERS).



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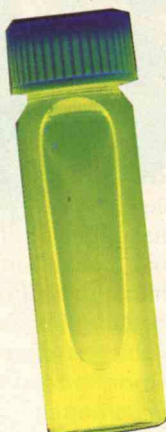
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MIT REPORTER



It's not just electrons
that are stimulated by
such properties; many re-
searchers are excited as
well, predicting a brilliant
career for nanocrystal-
lites as phosphors in flat-
panel displays for laptop
computers or televi-
sions. "Traditional ma-
terials have flaws—
they require too much
energy, for example,"
says Bawendi. And
optical and electrical
engineers are energized
over the possibility of using the new
materials to create tiny semiconductor
lasers that are more efficient than the
ones now used in equipment such as CD
players.

But Bawendi cautions that anyone
who promises practical uses is jumping
the gun. Many such visions assume that
nanocrystallites will behave the same
way in bulk as they do in isolation. He
and other researchers have only begun
to study arrays of the particles. With two
collaborators, for example, Bawendi
recently created two forms of bulk-scale
nanocrystallites: colloidal crystals (in
which particles in a suspension arrange
themselves in regular, crystalline pat-
terns) and thin films (in which ordered
layers of particles are deposited on a flat
base). On the upside, Bawendi and col-
leagues have succeeded in creating a
light-emitting diode (LED), a semicon-
ductor device that shines in response to a
voltage. On the downside, he says, the
interactions among spheres in bulk
materials is still barely understood.

For Bawendi, the biggest questions
about nanocrystalline solids pertain to
fundamental science—how a charge is
transported inside the new materials,
how they will react to external forces
such as electric fields, whether "doping"
the materials with impurities will make
them behave more like metals. "It would
be fun to make a little laser," he says,
"but right now I'm more interested in
what makes these materials tick."

—DAVID BRITTAN

FIGURING THE RISKS OF CLOSER RUNWAYS



As air travel relentlessly grows,
more and more planes need to
land at the nation's busiest airports at
roughly the same time. Most apparent
solutions to this looming lack of capac-
ity are unworkable. One idea—build-
ing new and larger airports—has been
dampened by the Denver International
Airport debacle, where airport construc-
tion was beset by cost overruns and
delays. Nor are beleaguered neighbors
enthusiastic about extending present air-
port perimeters. And while greatly
expanding the number of night-time
flights would help, most people prefer to
fly during other hours.

The Federal Aviation Administration
(FAA) is therefore examining another
option: runways 3,000 or even 2,500
feet apart that could operate simultane-
ously, even in inclement weather. Such
a change could boost landing capacity by
as much as 50 percent, since almost all
parallel runways used during instrument
flight conditions today are at least 4,300
feet apart.

The question is whether this solu-
tion—even if accompanied by improved
landing radar—would pose unaccept-
able risk that an aircraft approaching
the runway could accidentally stray into
an adjacent landing path. Any resulting
collision "would be catastrophic, with
probably no survivors," points out Ar-
nold Barnett, an MIT professor of oper-
ations research who has developed sta-
tistical models to evaluate air safety.
While such an event has never occurred
in the United States, Barnett says, the
FAA needs to know the probability of a
collision taking place under the contem-
plated change.

This matter partly requires estimat-
ing how often landing aircraft blunder
off course on final approach. (Determin-
ing the collision risk—given a blunder—is
the other requirement.) Because data
have not been systematically gathered,
very little is known about "whether
blunders are relatively frequent events or
freakish ones," says Barnett, whom the

aviation agency has asked for advice on determining a reasonable calculation of the rate. So far, estimates have varied widely, from 1 in 2,000 to 1 in 200,000 landings.

Once a reliable estimate of the blunder rate is in hand, the FAA could project the overall risk of reducing the distance between runways, and then decide whether this risk is acceptably low. Previous research by Barnett has

this effort would cost millions of dollars, however. A much cheaper approach, which has just been mandated, is to require air-traffic controllers to report all such events they witness. But, writes Barnett in a working paper, even though the new rules often grant immunity from possible punishment, controllers may still have "a natural tendency not to call attention to events in which their own performance was not

He offers a simplified example to show how different rules can yield different results. Suppose, he says, that "over a given year, three blunders have been reported by controllers, while a 10 percent sample of control-tower tapes uncovers two blunders, only one of which the controllers had reported." This situation would allow for at least three plausible estimates of that year's number of blunders.

From the fact that 1 unreported blunder was found in a 10 percent sample, a statistician could extrapolate that 10 blunders had gone unreported and thus that the total number of blunders was 10 plus 3, or 13. Alternatively, a researcher could divide the tally of 3 blunders by the controllers' observed reporting rate of 50 percent to yield an estimate of 6 blunders. Finally, since the controller reports were incomplete, one could discard them and reason that, since 2 blunders showed up in the 10 percent sample, the total number of blunders was roughly 20.

By presuming some arbitrary "true" value for the number of blunders and assessing the accuracy of each rule, and then by changing the presumed number and repeating the procedure many times, a statistician would find that the first method was consistently more reliable than the other two, Barnett says. The second technique suffers because it involves estimating the reporting rate from too little data, so extrapolating could result in massive errors. Similarly, the last technique, which depends solely on sampling only a small percentage of the time, could sometimes produce estimates with a large error.

In his more elaborate analysis for the FAA—in which he assesses which estimation rules are best for different sampling rates, and considers that the very act of sampling tapes might improve controller reporting rates—Barnett suggests that a 15 percent tape sampling could well offer the best estimate relative to the cost. That would provide roughly 70 percent of the accuracy provided by a complete tape review, at only some one-sixth the price tag.—CHARLES BALL



indicated that an individual faces a 1 in 7 million chance of dying during a scheduled jet flight in the United States. Thus, if the incremental risk associated with closer runways were relatively small—say, 1 in 500 million during inclement weather—the FAA probably wouldn't worry. But if the risk were relatively large—something like 1 in 500,000—the agency would be greatly concerned.

In seeking the blunder rate, the FAA could identify every such error by examining all control-tower computer tapes that record landing trajectories and all voice tapes of conversations between controllers and pilots. Barnett notes that

exemplary." Moreover, they might not want to "squeal" on an errant pilot. And even under formal guidelines, controllers' interpretations of what constitutes a blunder could differ.

Untangling a Statistical Thicket

Barnett has therefore considered a variety of reasonable ways of combining incident reports (using different assumptions of how much reporting controllers may do) with a random sample of tapes. For each case, he has also taken into account what he considers the best statistical method, or rule, needed to derive an estimate of the blunder rate.

Trends

Curbside Commodities

Environmentalists have long cheered the growing number of municipalities establishing curbside recycling programs. But the burgeoning recycling industry has increasingly caught the attention of the business community as well. As a sign of the financial interest, the Chicago Board of Trade—the nation's largest exchange for so-called futures trading in commodities like oil, corn, and pork bellies—decided late last year to add recycled plastic, paper, and glass to the list of items members can trade in.

The notion of adding trash to the commodities exchange garnered some chuckles from the business press when it was first announced, but a look at the numbers suggests that the venture makes sound business sense. Manufacturers in the United States spent some \$5 billion last year on recycled materials for use in their products. The amount of plastic recovered from the two most common types of bottles—PETE (polyethylene terephthalate) in soda bottles and HDPE (high-density polyethylene) in milk

jugs—tripled between 1990 and 1995, to 1.38 billion pounds. Even paper recycling, already well established by 1990, grew by more than a third during that period, to some 39 million tons. Industry experts estimate that more than 3,000 companies in the United States now include recyclables in the manufacture of some 4,500 products.

But despite the aggregate figures, a vigorous free market in recycled materials has lagged. The problem, according to Daniel Kemna, manager of recycling for Waste Management, the nation's largest hauler of recycled materials, is that the collection of recycled materials is highly decentralized, which leads to wide disparities in the handling and pricing of materials among different locales.

With few agreed-upon standards or quality grades in the emerging market, prices vary widely, says David Dougherty, director of the Clean Washington Center, a state environmental agency. In one extreme example last year, he says, corrugated cardboard was selling for \$200 a ton in Seattle but just \$35 in Spokane.

Because it aims to bring more open competition and standardization to the recycled materials market, the Chicago

Board of Trade's Recyclables Exchange has already attracted praise from Dougherty and other participants. The exchange "is the biggest shot in the arm for recycling in this country since municipal recycling efforts began in the 1970s," says Mark Lichtenstein, manager of a municipal trash program in Oswego County, N.Y., and president of the National Recycling Coalition, which includes buyers and sellers.

Recyclers like Lichtenstein are especially pleased with the nationwide exchange because municipalities like his have never before had such easy and direct access to prospective buyers. Most municipalities began curbside recycling programs either in response to a political mandate or as an effort to reduce the skyrocketing landfill fees they paid to dump their town's solid waste. Happy to divert a percentage of their weekly trash volume from the landfill, municipal trash directors like Lichtenstein often negotiated contracts with large recycling firms that yielded relatively little recompense for the municipalities' materials. "We tended to think of recycled materials as trash to dispose of," Lichtenstein says, "not as the valuable commodities they are."



With the Recyclables Exchange, Lichtenstein says, he can offer his wares to a wide spectrum of potential buyers and increase his chances of receiving a fair price for them. As testament to his belief in the effort, Lichtenstein actually made the exchange's first-ever trade last October when he sold 100 tons of old newspapers to the Weyerhaeuser Corp. for a respectable \$90 a ton.

Futures Trading

Now with a site on the World Wide Web, the Chicago Board of Trade's Recyclables Exchange works essentially as an industry-sanctioned computer bulletin board. So far, the exchange includes about 150 members, each of whom has paid the \$1,000 annual fee that allows them to trade. Logging on for a recent visit, for instance, revealed scores of listings. A party in New York offered 1,000 tons of sorted office paper at \$500 per ton. A buyer in Illinois sought 300,000 pounds of baled PETE bottles at 12 cents per pound. One listing from Kentucky, in a so-called miscellaneous category, even offered 200 gallons of grease. As on any exchange, these suggested prices serve as a starting point for nego-

tiations as buyers and sellers try to agree on a final price.

Jeffrey Campbell, senior product manager at the Chicago Board of Trade, says some 400 listings have been posted since the exchange went online last year. "The Recyclables Exchange is not instantly vibrant like the kind of raucous trading in the grain pit that people think of," Campbell says. "But it has attracted attention worldwide, and already we're seeing people trading with people they've never traded with before."

Campbell adds that interest in the exchange is growing steeply. A series of workshops to introduce members of the recycling industry to it is drawing strong interest, he says. More than 120 prospective new members signed up for workshops in Philadelphia, Boston, and Syracuse, and other such events are already scheduled.

Nevertheless, as Campbell points out, the Recyclables Exchange is a far cry from the usual activity at the Chicago Board of Trade. For established commodities like corn or wheat, traders speculate on the future market price and buy and sell contracts for the purchase or sale of the commodity at that price. Some 211 million such futures contracts

were sold last year through the Chicago Board of Trade. Futures traders contend that such speculation allows farmers and other agricultural investors a financial hedge against

anticipated gluts or shortages of a given commodity, helping to smooth out sharp fluctuations in the market.

Technically, traders on the recyclables exchange could gamble in the gray area between a cash and a futures market by closing a deal at the present price but specifying delivery at a future date, thereby speculating about whether the price of that given commodity might rise or fall. But

traders can't speculate about rising or falling prices of a given commodity unless it has a widely accepted fair-market value. To work as a viable organized market, futures trading requires widely accepted pricing standardization and a well-documented exchange record in the given commodity. The Recyclables Exchange aims to offer both.

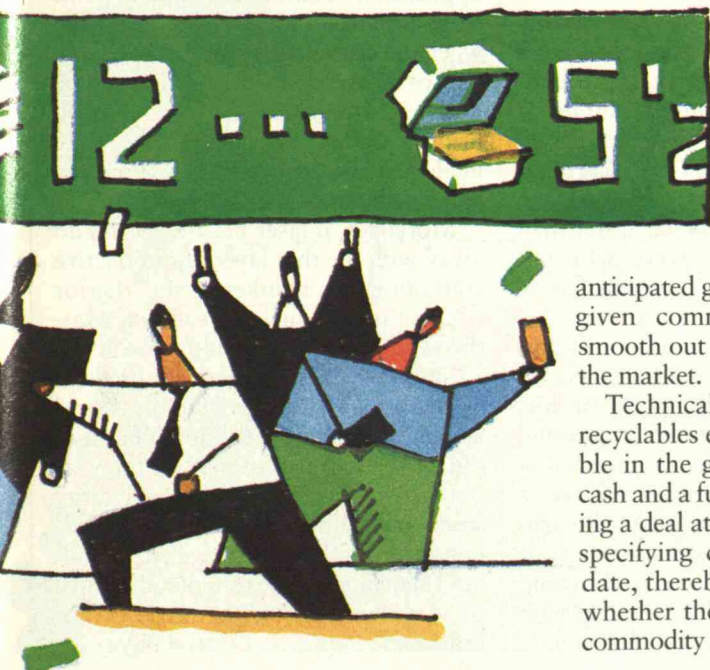
Campbell explains, though, that established futures markets all traditionally started with precisely the kind of cash market now instituted for recycled materials. "In 1848 when we started trading here in grain," Campbell says, "farmers would bring samples of their corn or wheat into the grain markets." A few decades later, he says, enough of a track record had been developed to establish the futures market.

The growth in the recyclables market and the advent of computer technology such as the World Wide Web, Campbell says, will combine to drive the swift development of a futures market in recyclable materials. "It won't take two decades," he says. "I'm sure of that."

Others seem similarly confident that a centralized exchange can help the trade of recycled material become even more institutionalized as a growing financial market—a prospect that is good for both business and the environment. Many big players in the emerging industry, including the 4,000-member National Recycling Coalition based in Alexandria, Va., several state recycling agencies, and even the U.S. Environmental Protection Agency, are partners in the Chicago Board of Trade's venture. With the strong endorsement of EPA director Carol Browner, the federal agency put up \$600,000 to help launch the exchange. Edgar Miller, director of policy and programs for the National Recycling Coalition, says the exchange has already accomplished a key goal: "establishing these materials once and for all as legitimate commodities."

—SETH SHULMAN

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Graffiti Busters

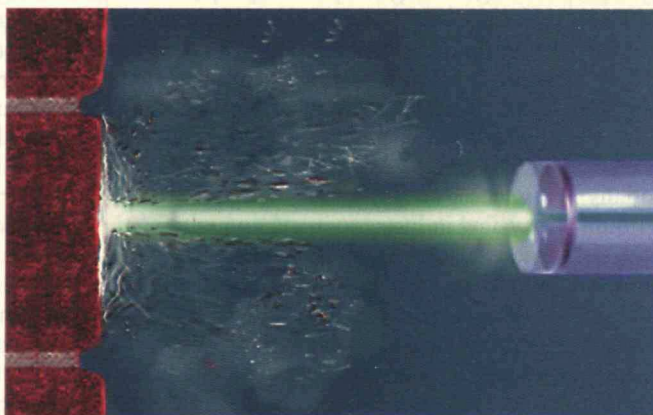
In one of the oddest examples of technology transfer, Lawrence Livermore National Laboratory, which brought us laser weapons powerful enough to vaporize incoming missiles, has aimed its laser technology toward the decidedly more down-to-earth problem of graffiti removal.

"Graffiti's kind of a hobby for me," says Dennis L. Matthews, a laser designer in Livermore's laser programs group, who spends his time dreaming up commercial uses for the lab's powerful lasers. So far such uses have included printing advanced electronic circuits and imaging objects in outer space. But after graffiti artists left their unsightly mark near his home in Half Moon Bay, a small town near San Francisco, Matthews decided to see if the lasers could eliminate such eyesores.

Normally, graffiti is a lot easier to apply than to remove. Thus even though communities in the San Francisco Bay area spend about \$10 million a year to combat graffiti and New York City annually doles out five times that amount, street artists spray on their works at a faster clip than city workers can remove them. Moreover, current removal remedies have nasty side effects. Sandblasting produces airborne sand and paint particles and mars surfaces beneath the paint, as do other abrasives. Chemical treatments such as high-pressure spraying of sodium bicarbonates (baking soda solutions) leave behind a messy slurry and a ghostly outline of the erstwhile graffiti on the wall.

Matthews believes he has developed a better way. He uses a device jaw-breakingly known as a neodymium-yttrium-aluminum-garnet or Nd:YAG laser. This powerful green laser produces some 10^{15} photons per pulse at the rate of 1,000 pulses per second. At that

intensity and frequency, the photon waves travel through the paint layer, ricochet off the hard wall beneath, and collide with incoming waves, right in the paint layer. In the same way that an opera singer's sound waves shatter a champagne glass, Matthews says, the photon waves explode the paint, and the



Photons fired from a high-energy laser at the rate of 1,000 pulses per second bounce off a hard wall and collide with other incoming photons, exploding the thin layer of paint at the surface and reducing it to a fine powder.

street artist's handiwork winds up as a fine dust on the ground.

Ultimately, Matthews expects a commercial version of his machine to scour a 5-foot-high swath of freeway soundproofing wall at the rate of 600 linear feet per hour, or approximately 3,000 square feet per hour. "I like that number because it's faster than you can paint," he says. It's also far faster than conventional soda sprayers, which at best clean only 100 to 200 square feet an hour.

Matthews says his device will also remove paint from any surface, including brick, cinder block, wood, plastic, window glass, and polished ornamental stone, such as marble or granite. It creates no hazardous fumes and leaves a dry powder that can be swept or vacuumed up. Perhaps most important, it will not damage walls beneath the paint. Soda sprayers pummeling a surface with 3,000 pounds of pressure per square

inch can etch underlying surfaces, and, in the case of ornamental stone, require costly repolishing.

Matthews says he can build a prototype graffiti-removal system in nine months for about \$2 million. A commercial version, which he imagines could be on the market in several years, might cost \$250,000. That is considerably more than sodium-bicarbonate sprayers, which run about \$30,000. But Matthews hopes that the laser's much greater efficiency would more than justify the higher initial investment.

Matthews is now negotiating with possible commercial partners who would develop a self-contained, portable unit with a built-in vacuum to suck up the paint dust, and is approaching graffiti-buster's biggest potential customers, city officials, to stir up interest in the technology. He's also envisioning other uses for his invention that are as wide-ranging as there are surfaces to clean. Perhaps the biggest application would be stripping paint from airplanes and buildings, especially when the coating is hazardous. Roughly half of all American homes bear toxic lead-based paint, as do some 90,000 bridges. Today's stripping methods are inadequate because there is no practical way to guarantee lead containment.

Moreover, if laser blasting could do away with the thin layer of radioactive contamination blanketing the interior of commercial nuclear reactors, Matthews says, engineers could reuse about 82,000 metric tons of steel and several thousand metric tons of stainless steel and copper just from the dozen facilities due to be decommissioned by the year 2000. Other Department of Energy stockpiles valued at more than \$1 billion could similarly be recycled, including 1.3 million metric tons of radioactive stainless steel and 38,000 metric tons of radioactive copper.—PETER TYSON

Sustainably Developing the DMZ

Before their peninsula was torn by civil war, Koreans referred to their country as Keum-Su-Kang-San—the land of embroidered rivers and mountains. Now most of the natural resources in densely populated North and South Korea have been devoured. But Ke Chung Kim, professor of entomology and director of the Center for Biodiversity Research at Pennsylvania State University, has a novel plan to preserve the Keum-Su-Kang-San in an unlikely spot: the Korean Demilitarized Zone (DMZ). If Kim's proposal for a so-called peace park in the DMZ is adopted, it has the potential not only to preserve biodiversity in the region but also to ease the hostility between North and South Korea by fostering mutually sustainable development of the park's natural resources.

Specifically, Kim proposes to establish a jointly held Korea Peace Bioreserves System: a network of wildlife preserves, international parks, and managed ecosystems in and around the DMZ, which ironically has become a sanctu-

ary for endangered plants and animals over the past 40 years. Indeed, only a few military personnel have stepped inside this no-man's land since the Korean War ended in 1953. "There is really no other place in the world where more than 3,000 years of farming suddenly stopped and the reestablishment of native species was allowed to occur without the intrusion of people," says Kim.

The reserve would encompass the 4.8-mile-wide zone itself, which roughly straddles the 38th parallel for 148 miles across the Korean peninsula, plus the 3-mile-wide buffer zone that lies on each side of the zone. This 1,600-square-mile habitat might eventually be extended further to include the Taebaek mountains to the east and the forested plains and deltas of the Han-gang and Imjing-gang rivers to the west.

A team of South Korean scientists conducting a field survey in the southern buffer zone in 1987 identified 41 native and 40 rare plant species, and 16 native and 8 rare fish species. They also found 14 species not previously known to inhabit the area, including a relative of the timber wolf, and healthy populations of 8 species that are threatened or

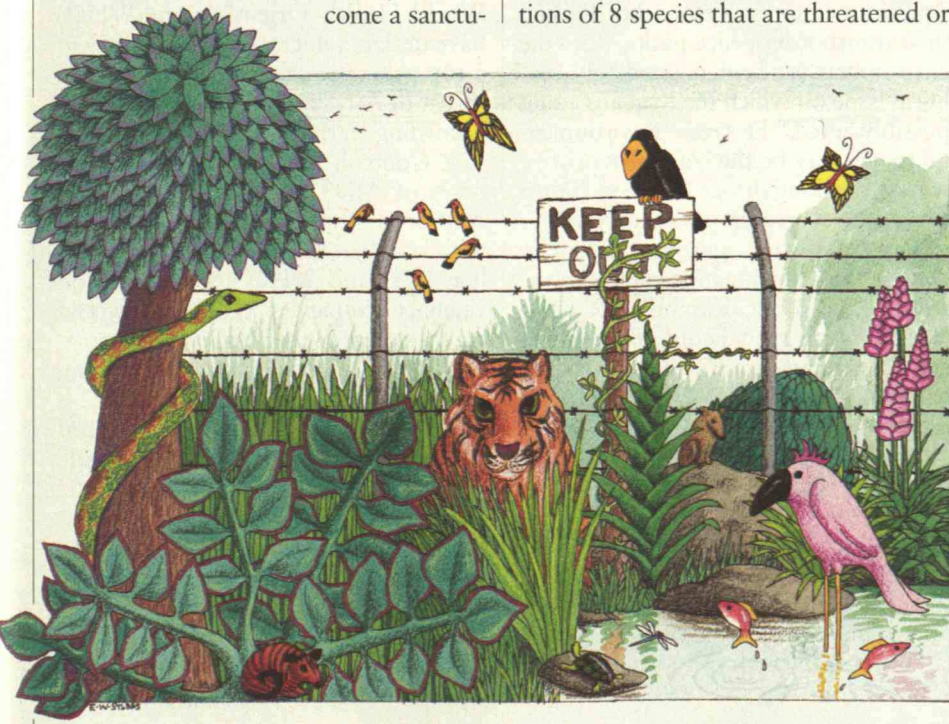


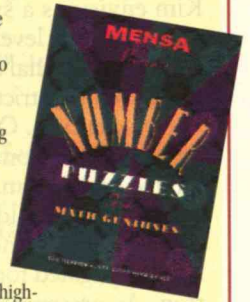
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endangered elsewhere, including the Manchurian tiger and the Siberian bear.

To preserve this biological wealth, Kim envisions a system of bioserves under various levels of protection. Sensitive areas crucial to endangered species would remain strictly off-limits to all but a few scientists. Other areas would be designated national parks, supporting limited ecotourism. Organisms in designated areas would be screened for potential medical and commercial utility and propagated for commercial production. As pressures arise from adjacent populations to develop the DMZ, he says, the bioserve will be accepted only if local citizens and both governments

numerous governments, including the U.S. Department of State, North and South Korea, and international conservation organizations such as the United Nations Environment Program, to bolster support for the plan. He has already achieved some measure of acceptance in North Korea as he has been working on other conservation activities, including a plan for sustainable development of the country's natural resources, with one of its key players, U-Il Pak, director of the Center for Nature Conservation in North Korea's Academy of Sciences.

Having studied numerous peace parks, Arthur Westing, of Westing Associates in Environment, Security, and

Because it has remained off limits to human incursions for 40 years, the Demilitarized Zone (yellow) between North and South Korea is now home to dozens of rare species.



realize that the land is worth more if developed for long-term sustainable use.

Successful transborder reserves such as La Amistad International Biosphere Reserve between Costa Rica and Panama, and the Trifinio Trinational Conservation and Development Zone shared by Guatemala, El Salvador, and Honduras allow sustainable use of natural resources in some areas, as Kim proposes. Meanwhile, ecotourism and the search for commercially and medicinally useful substances have greatly expanded the number and types of local jobs. Such international parks have also diffused tensions by convincing rival neighbors to collaborate on protecting watersheds, curbing soil erosion, and slowing deforestation for their mutual benefit.

The Asia Foundation, a private philanthropic organization, has provided Kim with seed money to publicize his idea and enlist international support, since cooperation between the Koreans could increase trade in the area, possibly in new naturally occurring products. Thus far Kim has met with officials from

Education, in Putney, Vt., says that the tension between the two Koreas is much stronger than that between Central American countries before they formed their transborder peace parks. But "the environment is a benign, seemingly apolitical issue on which the Koreans could possibly agree," he says. "Environmental issues may be the least provocative way of breaking the ice." Indeed, North and South Korea have already pledged to work jointly on environmental issues and establish reunification commissions.

In the meantime, Kim hopes to organize an international conference of scientists, scholars, government, and international conservation organization representatives to hammer out the details of the proposed system of reserves, including what role each group will play in its governance. After gaining some international approval, he will contract with a joint team of Korean and U.S. social scientists to conduct a socioeconomic analysis of the various proposed land uses in the reserve system.

—JOY DROHAN

All-Natural AIDS Protection?




■ Skin of frog and liver of a shark... the makings of a magic potion? Not exactly. But medical researchers are hoping that natural substances derived from these animal sources will serve as the basis of new vaginal foams and creams to protect against both pregnancy and sexually transmitted diseases (STDs).

Two compounds now in preclinical trials appear not only to act as spermicides but also to be capable of combating diseases such as genital herpes, gonorrhea, and even AIDS, according to Dorothy MacDonald, director of microbiology at Magainin Pharmaceuticals, the company studying the safety and efficacy of the compounds with the help of the National Institutes of Health (NIH).

The research is among the most promising of a growing number of innovative efforts to develop topical microbicides capable of killing disease-causing organisms such as bacteria and viruses. Both NIH and the United Nations' World Health Organization (WHO) have declared microbicide development a top priority because of the growing threat of AIDS among women. In fact, according to the U.S. Centers for Disease Control, more than 14,000 new cases of AIDS were reported among American women in 1994, compared with less than 3,700 just five years earlier. NIH and WHO are focusing on vaginal microbicides because they would give women greater ability to protect themselves against AIDS by lessening reliance on condoms.

The discovery of the new natural compounds was serendipitous. While using African clawed frogs for genetic research at NIH in 1987, biochemist Michael Zasloff noticed that when he returned frogs that he had operated on to an aquarium tank of bacteria-filled water, their surgical wounds rarely became infected. Abandoning his original research, he isolated two peptides in



Pam Jones is a chemical engineer, mother of two, nature lover and part of a team that pioneered a revolutionary regeneration process called PetretecSM. It takes used polyester plastic, unzips the molecules and allows it to be reused, good as new. An everyday jar can become a videotape, then a seat belt, then a designer shirt. "Evergreen polyester," Pam says, "the cycle continues on and on."

She can turn this jar into a designer shirt.

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**all 3 by Dr. Abbie Salny and
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TRENDS

frog skin capable of killing a variety of disease-causing microbes and dubbed the family "magainin"—Hebrew for shield. Since that time, his company, which he named after his discovery and established in Plymouth Meeting, Pa., has produced and studied several thousand synthetic chemical compounds structurally similar to natural magainins.



Compounds derived from African claw frogs (left) and dogfish sharks (right) may soon be used in vaginal creams that provide powerful yet nonirritating protection against pregnancy and sexually transmitted diseases, including AIDS.

Inspired by a marine biologist's observation that sharks seldom develop infections, he then began testing for similar antimicrobial activity in the stomach of the dogfish shark, and in 1993 reported the discovery of a steroid he named squalamine after the shark's scientific name, *Squalus acanthias*, and the substance's chemical structure as an amine. The steroid, which has since been found in abundance in the shark's liver, was the first of 18 so-called aminosterols subsequently discovered, each with microbe-fighting properties.

Acting as the first line of defense, magainins and aminosterols allow animals to respond rapidly to infectious organisms. By contrast, the immune system's antibodies and T-lymphocytes, or T-cells, take longer to mount attacks and are most effective on second exposure to the organisms.

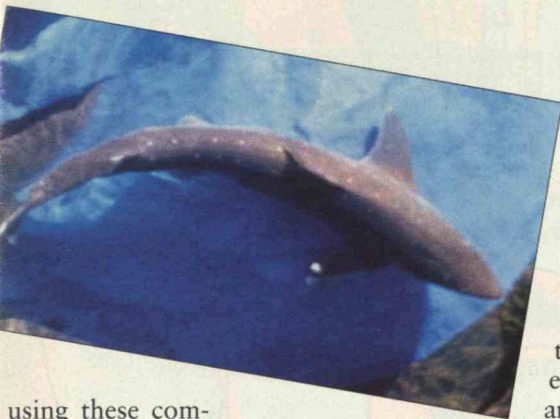
Scientists at Magainin Pharmaceuticals believe antimicrobial peptides—which have also been identified in the epithelial cells of cow tongues—are present in most animals, including humans. This would explain, Zasloff says, why you can burn your tongue eating hot foods like pizza and rarely get an infection, despite the millions of bacteria present in your mouth.

In what one might call a case of fatal attraction, the magainins, which have an overall positive charge, bind selectively to microbes, which are more negatively charged than the animal's own cell membranes. Magainins appear to work by enveloping microbes, inserting themselves through the membranes, and forming channels through which the contents of the cell leak out, resulting in cell death.

Aminosterols work differently, attaching themselves to the invading microbes at specific receptor sites on the cell membranes and, in the process, blocking the cell's normal mechanism for regulating cell volume and internal acidity. By interfering with these functions, the aminosterols stop the cells from proliferating.

In test-tube experiments the compounds have been shown to kill both sperm cells and a wide spectrum of organisms known to cause STDs. But that alone is not what makes them potentially useful, says Zasloff. Any medication also has to be nonirritating to the vaginal lining. "After all, nitric acid kills sperm and microbes," he says, but it would also cause severe burns.

In fact, animal tests have thus far shown the compounds to be both potent and non-irritating. Much of Magainin's animal research focuses on



using these compounds to combat the herpes virus, which causes a painful infection that afflicts millions of Americans, including some 400,000 new cases each year. The researchers chose the herpes virus because it can be tested in laboratory animals. Other STDs, such as HIV, are specific to humans.

In studies of female mice infected with the herpes virus, the scientists compared

the magainin peptide and shark aminosterol with nonoxynol-9 (N-9)—which is often used as a benchmark in studies because it is a widely used contraceptive that has shown some effectiveness as a microbicide. They found that the compounds proved more effective in inhibiting the virus and less irritating than N-9.

Magainin researchers and a team under the direction of Nancy Alexander, chief of the contraceptive development branch at NIH, have also completed preliminary studies on tolerance of the magainins and aminosterols in rabbits. They likewise found that after repeated use, both compounds were nonirritating.

NIH will help Magainin Pharmaceu-

ticals finance and conduct initial studies on humans of the magainins and aminosterols. The clinical trials will check toxicity and test both contraceptive efficacy and the ability to protect against STDs, including herpes, gonorrhea, and AIDS.

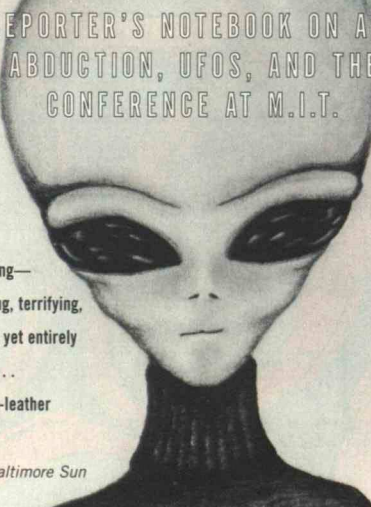
Human trials will be costly because they will be large. And they'll be large in order to deal with a dilemma: In AIDS trials, for example, researchers must advise people to use condoms, which are known to be protective. "If you're really successful, you'll reduce the spread of HIV just by telling people to use condoms, but you won't know if the new product is effective," says Alexander. "To counteract that, you must have a very big study, so you'll get some people who won't use condoms but will use the product."

—NANCY KNOBLOCK HUNTON

CLOSE
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THE FOURTH KIND
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PENGUIN
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By Garland E. Allen

Science Misapplied:

The Eugenics Age Revisited

Seeking relief from extreme economic hardships after the First World War, Nazi Germany based its misguided campaign to eliminate “unproductive” members from its society on the fledgling field of genetics. Given similar economic pressures and a renewed search for genetic roots to social problems, what’s to stop us from following a similar course today?

IN 1935, two years after the Nazi takeover, a German high-school math textbook was published that contained the following problem: “In one region of the German Reich there are 4,400 mentally ill in state institutions, 4,500 receiving state support, 1,600 in local hospitals, 200 in homes for the epileptic, and 1,500 in welfare homes. The state pays a minimum of 10 million RM [Reich Marks]/year for these institutions.

I. What is the average cost to the state per inhabitant per year?

II. Using the result calculated from I, how much does it cost the state if:

- a. 868 patients stay longer than 10 years?
- b. 260 patients stay longer than 20 years
- c. 112 patients stay longer than 2 years?”

Another problem asked the students: If the construction of an insane asylum requires 6 million RM, how many housing units for normal families could be built at 15,000 RM apiece for the amount spent on insane asylums?

If the economic message from these problems were not plain enough, a pamphlet published by a member of the Nazi Physician’s League the year before put it in unmistakably blunt terms: “It must be made clear to anyone suffering from an incurable disease that the useless dissipation of costly medications drawn from the public store cannot be justified. Parents who have seen the difficult life of a crippled or feeble-minded child must be convinced that, though they may have a moral obligation to care for the unfortunate creature, the broader public should not be obligated...to assume the enormous costs that long-term institutionalization might entail.”



Illustration by Yuri Nakatani

The Nazis referred to those who required the continual expenditure of medical resources from the public treasury as “useless eaters” or “lives not worth living.” Such terms were also applied to the elderly, the chronic poor, and the crippled. These “misfit” individuals, assumed to be the offspring of hereditarily defective parents, were deemed a burden on the rest of society.

In 1933 these concepts had been given legal status when the Reich Cabinet passed the “Law on Preventing Hereditarily Diseased Progeny,” calling for involuntary sterilization of all those identified as bearers of hereditary disease. These “diseases” included not only clinically definable conditions, such as Huntington’s disease, hereditary blindness, deafness, and epilepsy, but also more nebulous social and behavioral traits such as “feeble-mindedness,” “pauperism,” and alcoholism.

What would bring a nation to the point of viewing its own citizens—its most unfortunate and helpless

better breeding.” To both men, better breeding implied improving the quality of the human species using the findings of modern science, particularly the science of heredity. Eugenics was thus viewed as the human counterpart of modern scientific animal and plant husbandry. In fact, it seemed ironic to eugenicists that people paid so much attention to the pedigrees of their farm and domestic stock while they ignored the pedigrees of their children.

The purpose of eugenics, Galton wrote, “is to express the science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognizance of all influences that tend in however remote a degree to give the more suitable races or strains of blood a better chance of prevailing over the less suitable than they otherwise would have had.” In this brief definition, Galton lays out all the dimensions that came to characterize eugenics as an ideology and social/political movement

U.S. EUGENICIST CHARLES DAVENPORT CONCLUDED IN 1921 THAT GERMANS RANKED

HIGHEST IN LEADERSHIP, HUMOR, GENEROSITY, SYMPATHY, AND LOYALTY, WHILE IRISH

PEOPLE WERE THE MOST “SUSPICIOUS” AND JEWISH PEOPLE THE MOST “OBTRUSIVE.”

members at that—as useless lives, as nothing more than an economic burden on society? More important for us today, was this a phenomenon unique to fascist Germany, or could it happen in the United States?

To understand whether such attitudes could flourish here, it is instructive to examine the history of the science—in particular a branch of biology that came to be known as eugenics—that served as the foundation for the German ideology of “lives not worth living.” Such a review will reveal, first of all, that a similar movement not only could, but in fact *did* occur in the United States. More significant, it will also show that the forces driving the original eugenics movement—a mentality that blames the victim for shrinking economic resources and a misguided faith in genetic science to label and formulate social policy about so-called unproductive members of society—may be at play once again today.

Breeding Better People

The term eugenics was coined in 1883 by Sir Francis Galton, Charles Darwin’s cousin and an early pioneer of statistics, to refer to those born “good in stock, hereditarily endowed with noble qualities.” More directly, according to Galton’s U.S. disciple, Charles Davenport, eugenics was the science of “the improvement of the human race by

during the first half of the twentieth century:

- A firm trust in the methods of selective breeding as an effective means of improving the overall quality of the human species.
- A strong conviction of the power of heredity to directly determine physical, physiological, and mental (including personality) traits in adults.
- An inherent belief in the inferiority of some races and superiority of others—a view extended to ethnic groups and social classes as well.
- A faith in the power of science, rationally employed, to solve pressing social problems, including ones so seemingly intractable as urban and labor violence, and to eliminate various forms of mental disease, including manic depression, schizophrenia, and feeble-mindedness.

Steeped in such grandiosity and ethnocentrism, U.S. eugenicists pursued research on the inheritance of a variety of physical, mental, and personality traits. But since they primarily used family-pedigree charts, which were often based on highly subjective and impressionistic data collected from family members, the eugenicists’ understanding of genetics was often simplistic and naive, even for the early decades of this century. For example, in a 1919 study based on analysis of pedi-

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grees, Davenport claimed that thalassophilia, or “love of the sea,” was a sex-linked Mendelian recessive trait appearing in families of prominent U.S. naval officers. That the trait must be sex-linked seemed clear, since in pedigree after pedigree only males in the various families observed ever became naval officers.

Other traits such as alcoholism, pauperism, prostitution, rebelliousness, criminality, feeble-mindedness, ability to excel in chess, and even forms of industrial sabotage such as “train wrecking” were all claimed to be

ranked lowest. The Irish ranked highest in “suspiciousness,” while Jewish people ranked highest in “obtrusiveness.” Davenport assumed, of course, that most if not all such traits were genetically determined, and the social behaviors of not only individual family members, but also whole nations, were genetically fixed at birth.

Not surprisingly, eugenicists also developed close ties with the newly emerging profession of psychometrics, the psychological theory of mental measurement, which was eagerly being employed to develop standardized IQ tests. Prominent psychometricians—such as Lewis Terman, who created the Stanford-Binet IQ test for preschool children, and Robert Yerkes, the psychologist from Harvard who designed and directed the administration of the Army IQ tests during World War I—believed the mental functions they were measuring were innate, or genetically determined, and therefore that training and education could accomplish only as much for certain social and ethnic groups as the “raw material” of their mental capacity would allow.

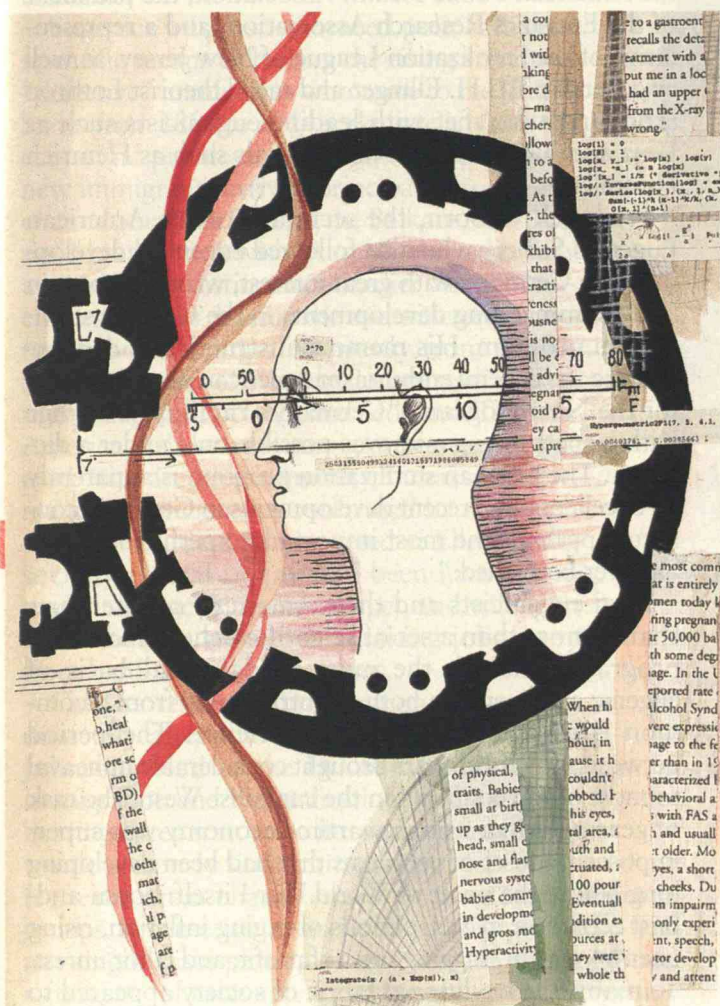
For their part, eugenicists welcomed the IQ test as an objective and quantitative tool for measuring innate mental ability. For example, on the basis of IQ tests given to immigrants arriving at Ellis Island, eugenicist Henry H. Goddard “discovered” that more than 80 percent of the Jewish, Hungarian, Polish, Italian, and Russian immigrants were mentally defective, or feeble-minded. Goddard believed that such a defect was “a condition of the mind or brain which is transmitted as regularly and surely as color of hair or eyes.”

Meanwhile, a host of organizations were formed to support eugenics research. In 1910, Davenport established the first major eugenics institution in the United States, the Eugenics Records Office (ERO), which served until 1940 as both a center for eugenics research, complete with an office staff and a battery of field workers, and as a repository for eugenic data (mostly family pedigrees). In 1913, the Eugenics Research Association was founded to bring together those interested in the latest eugenical investigations.

In 1918, the Galton Society began meeting monthly at the American Museum of Natural History in New York to hear papers on eugenics and related subjects. And in 1923, the American Eugenics Society, which grew to include more than 1,200 members and branch organizations in 29 states by the end of the decade, was formally launched as a result of a proposal drawn up at the International Congress of Eugenics in New York in 1921. Elsewhere, J.H. Kellogg, the cereal magnate from Battle Creek, Mich., founded the Race Betterment Foundation in the years just before World War I, while eugenics education societies formed in Illinois, Missouri, Wisconsin, Minnesota, Utah, and California.

determined by one or two pairs of Mendelian genes. When one of Davenport’s friends, a professional psychiatrist, criticized him for lumping complex human behaviors into single categories such as insanity, he dismissed the criticism as being “uninformed.”

Such simplistic models for complex behaviors were extended to explain the differences between racial, ethnic, and national groups. In a study of the “Comparative Social Traits of Various Races” in 1921 (based on a series of questionnaires given to school children), Davenport concluded that Germans ranked highest on qualities such as leadership, humor, generosity, sympathy, and loyalty, while on these same traits Irish, Italian, and in two cases (loyalty and generosity) British people



Pursuing the educational front, eugenicists promoted the science through popular accounts such as *Mankind at the Crossroads* by E.G. Conklin (1914), *Passing of the Great Race* by Madison Grant (1916), *The Rising Tide of Color Against White World Supremacy* by Lothrop Stoddard (1920), *Applied Eugenics* by Paul Popenoe and Roswell Johnson (1923), and *The Fruit of the Family Tree* by Alfred E. Wiggam (1924). These and other works presented the spectre of race degeneration and the takeover of modern society by degenerates and "foreigners" who were all out-breeding the staunch, established white Anglo-Saxon stock.

Finally, several textbooks, including *Genetics and Eugenics* by W.E. Castle (1916, 1923) and *Evolution, Genetics, and Eugenics* by H.H. Newman (1921, 1925, 1932), took the technical message of eugenics to the classroom. By 1928, the American Genetics Association boasted that there were 376 college courses devoted exclusively to eugenics. High-school biology textbooks followed suit by the mid-1930s, with most containing material favorable to the idea of eugenical control of reproduction. It would thus have been difficult to be an even moderately educated reader in the 1920s or 1930s and not have known, at least in general terms, about the claims of eugenics.

The Search for Order

Though the eugenics movement eventually became a worldwide phenomenon—with contributions from scientists and laypeople in England, France, Italy, Scandinavia, Latin America, and Russia—by far the most work occurred in Germany and the United States, whose eugenicists had formed a particularly strong and direct bond, especially after the Nazis came to power in 1933. As early as the mid-1920s, American eugenicists such as Davenport and Harry H. Laughlin, superintendent of the Eugenics Records Office, were already well known to German authorities such as Fritz Lenz, professor of racial hygiene at the University of Munich. Indeed, in 1928 Lenz requested permission from Laughlin to reprint his article "Eugenical Sterilization" in the *Archiv für Rassen und Gesellschaftsbiologie* (*Archive for Race and Social Biology*). Laughlin responded enthusiastically: "I should feel highly honored to have this paper appear in the *Archiv*. Your many American friends trust that some time in the near future you will be able to visit the centers of eugenical interest in this country."

More directly, the Nazis used a model Laughlin had devised as the basis for their own sterilization law in 1933. In recognition of this critical role, Laughlin was given an honorary doctorate of medicine degree from Heidelberg University in 1936, which he enthusiastically accepted at the time of the university's 550th anniversary celebration. Meanwhile, Davenport, a Harvard alumnus, arranged for a delegation of German eugeni-

cists to participate in Harvard's 300th celebration later the same year.

Other U.S. eugenicists were keenly interested in how the Nazis were progressing with eugenical programs, from sterilization legislation to popular education. In fact, a number of Americans visited Germany in the 1930s to meet with their colleagues and visit the "eugenic courts," which the Nazis had set up to pass judgment on cases where compulsory sterilization was recommended. The visitors included the secretary of the American Public Health Association, the president of the Eugenics Research Association, and a representative of the Sterilization League of New Jersey, as well as geneticist T.U.H. Ellinger and racial theorist Lothrop Stoddard, who met with leading eugenicists such as Lenz and high-ranking Nazi officials such as Heinrich Himmler.

Frederick Osborn, the secretary of the American Eugenics Society who also followed eugenical developments in Germany with great interest, wrote a report in 1937 summarizing developments in the German sterilization program. His memo is instructive in demonstrating the general enthusiasm American eugenicists felt for the Nazi program: "Germany's rapidity of change with respect to eugenics was possible only under a dictator....The German sterilization program is apparently an excellent one....recent developments in Germany constitute perhaps the most important experiment which has ever been tried."

Nazi eugenicists and their American counterparts shared more than a set of scientific beliefs and social programs; indeed, the most fundamental basis of eugenic arguments in both countries grew from a common economic and social experience. The period between the World Wars brought considerable upheaval to most of the countries in the capitalist West. The task of gearing down from a wartime economy was superimposed on a set of problems that had been developing long before the onset of World War I itself: boom-and-bust economic cycles, periods of raging inflation, rising unemployment, sagging rates of profit, and labor unrest. To many, the traditional fabric of society appeared to be unraveling.

In both Europe and the United States, the response to these conditions by those with economic and political power was to search for ways to bring a *laissez-faire* economy (which operates with relatively little governmental interference), and the political and social practices attached to it, under control. Historian Robert Wiebe of Northwestern University has termed the period from 1890 to 1930 as "the search for order."

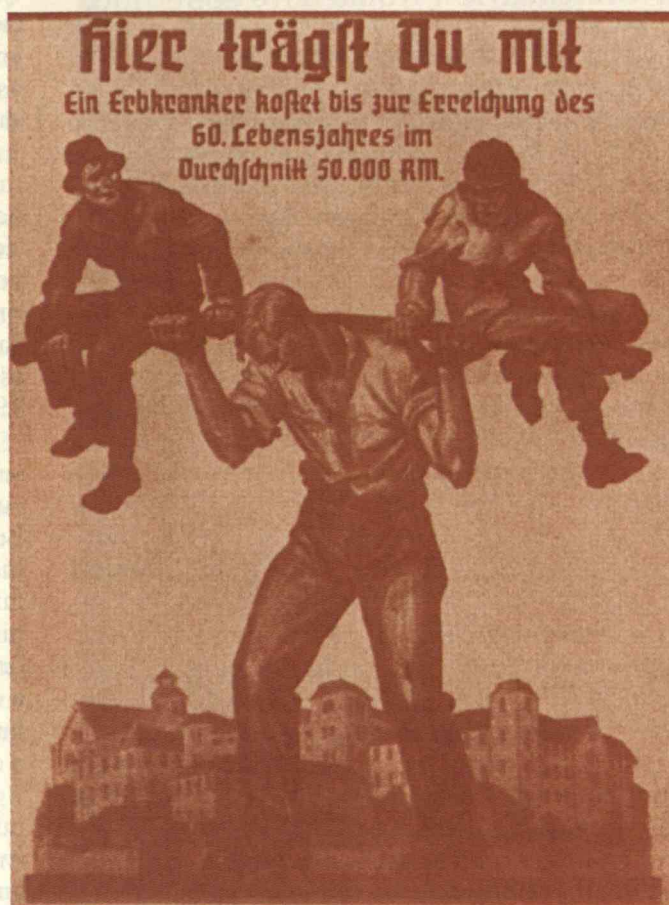
In the United States, this search was tied to a movement known as "progressivism" and its political incarnation, the Progressive Party, whose representative, Theodore Roosevelt, held the presidency from 1901 to 1909. Progressive ideology, which called for rational planning and scientific management of every phase of

society, was seen as the new and “modern” approach, and hence “progressive” by the standards of the day. For *laissez-faire* views it substituted an emphasis on state intervention and promoted the use of trained experts in setting economic and social regulatory policies. And it preached the doctrine of efficiency, which applied cost-benefit analysis and emphasized solving problems at their root, rather than after a crisis has arisen, for example, as in preventive medicine.

Eugenics was first embraced politically as a scientific means of halting the rising stream of “defective” immigrants who came to the United States from 1880 to 1914 seeking relief from the economic problems besetting Europe. These new immigrants arrived principally from Eastern and Southern Europe, the Balkans, and Russia. Many were Jewish. And all were ethnically and culturally distinct from earlier waves of foreigners, such as those in the mid-nineteenth century who had migrated mostly from Anglo-Saxon countries of Western Europe such as Germany, England, Ireland, and Scotland. To many Americans these new immigrants were considered “the dregs of humanity,” unassimilable, mentally deficient (as confirmed by tests such as those Goddard administered at Ellis Island), socially radical (many had been involved in trade-union activities in Europe), and willing to work for low wages, thus taking jobs away from hard-working Americans.

Calls for restricting immigration grew so dramatically after the war that in 1921 Albert Johnson, head of the House Committee on Immigration and Naturalization, held a series of hearings preparatory to introducing a bill that would seriously limit immigration, especially from the areas characterized by the new immigrant groups. Because any restriction had to appear to be fair, not singling out particular countries or ethnic groups as targets, Johnson appointed Laughlin of the Eugenics Records Office as “expert eugenics witness.” In this capacity, Laughlin testified twice before the House Committee on Immigration and Naturalization. In 1922, he cited IQ data, Army test results, and family pedigree analyses of institutionalized persons to demonstrate the defective biological nature of the new immigrants. His message was that biology, specifically genetics, was crucial in considering such social and political questions as those surrounding immigration, and that little or no attention had been paid to this in the past.

Laughlin’s point seemed eminently rational: it was inefficient and wasteful of taxpayers’ money to care for the world’s socially inadequate all their lives; better simply to prevent them from entering the country in the first place. For legislators worried about the nation’s

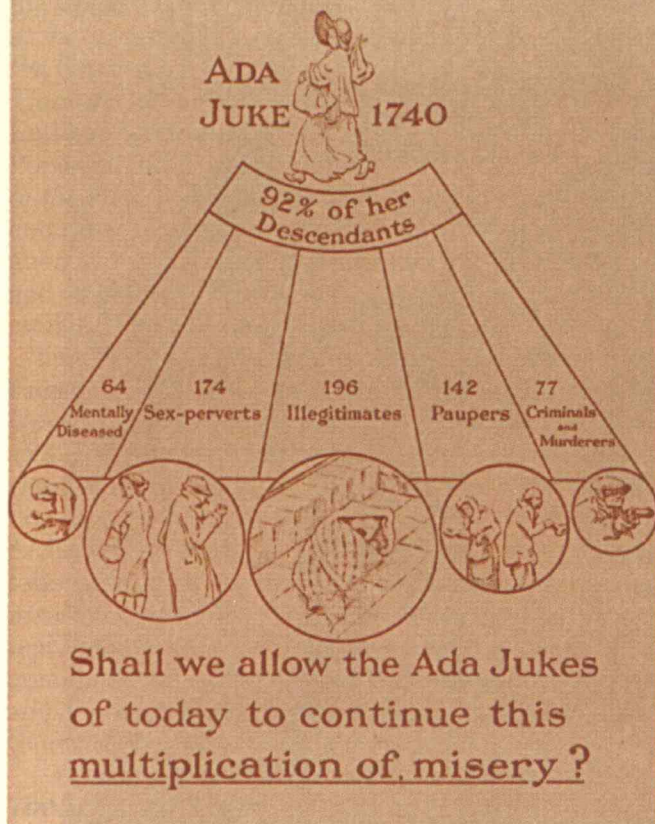


This Nazi-era poster from an exhibit on racial hygiene warns readers: “You are sharing the load. A genetically ill individual costs approximately 50,000 Reichsmarks by age 60.”

budget and facing staggering social problems of rising unemployment, labor strikes, and inflation, Laughlin’s emphasis on the eugenical point of view as rational and efficient management was seductive.

In his second official testimony—in 1924, shortly before the immigration bill went to the floor of Congress—Laughlin presented data showing that prisons and mental asylums housed a disproportionate number of immigrants from the very geographic areas that many nativists wanted to restrict. Two committee members, representing largely immigrant constituencies, protested that Laughlin’s information was subject to a variety of interpretations, and in response another biologist, Herbert Spencer Jennings from Johns Hopkins University, was called to comment on Laughlin’s data and conclusions. Jennings thought Laughlin’s analysis of the immigration data was grossly overstated, but Jennings was given only five minutes to testify on the last day of the hearings, and thus had almost no

Her sterilization would have cost \$150.



The Sterilization League of New Jersey, active in the 1930s, pointed to the descendants of hereditarily "degenerate" Ada Juke as evidence that "the elimination of a few defective lines would result in an enormous reduction in our public bills."

impact on the subsequent immigration legislation.

The Johnson Act, as it was called, duly passed in 1924, restricted annual immigration from any region to 2 percent of the number of residents from that region already living in the United States as of the 1890 census. Since the vast bulk of the new immigrants had arrived after that date, the Johnson Act, as hoped, restricted these groups most heavily. Immigration from Eastern Europe fell from 75 percent of the total immigration in 1914 to 15 percent after 1924. Laughlin and U.S. eugenicists in general considered the passage of the immigration act a great political triumph.

Managing Reproduction

Eugenicists similarly argued that if unemployment and crime resulted from the behavior of genetically inadequate persons, then clearly the most rational solution was to prevent those

types from being born in the first place. It was inefficient, they contended, to allow the biologically degenerate and unfit to reproduce, merely to fill the insane asylums, hospitals, and prisons with defective people that the state must support the rest of their lives.

Such efficiency arguments permeated eugenic literature. For example, eugenicists pointed out that it would have cost less than \$150 in 1790 for the state of New York to have sterilized Ada Juke (the pseudonym of a young woman whose impoverished descendants were the subject of one of the first eugenic studies by American sociologist Richard Dugdale in 1874), while the estimated cost of caring for her descendants by the 1920s had topped \$2 million.

Using the argument for national efficiency, eugenicists successfully lobbied for the passage of a number of state eugenical sterilization laws in the 1920s and 1930s. Eugenical sterilization was aimed specifically at those individuals in mental or penal institutions who, from family-pedigree analysis, were considered likely to give birth to socially defective children. Sterilization could be ordered any time after a patient had been examined by a eugenics committee, usually composed of a lawyer or family member representing the individual, a judge, and a doctor or other eugenic "expert."

In the end, more than 30 states had enacted such compulsory sterilization laws by 1940. And between 1907 (when the first such law was put into effect in Indiana) and 1941, more than 60,000 eugenical sterilizations were performed in the United States. Moreover, most state sterilization laws were not repealed until after the 1960s.

Logical Conclusions

Other countries—most notably England, France, and Italy—had their own versions of progressivism, but nowhere did the ideology of efficiency and scientific planning hold greater sway than in Germany. After World War I, restrictions imposed on the defeated nation in the Treaty of Versailles, enormous public and private pre- and post-war debt, the loss of overseas colonies and of the iron- and coal-rich regions of the Rhineland, and heavy reparations payments all converged to heighten the already existing problems of prewar inflation, unemployment, and the growing strength of organized labor. When the terms of Versailles became known, Germany experienced a series of upheavals that threatened to equal or surpass those of the Bolshevik revolution in Russia in 1917. General strikes and immense loss of morale made Germany a more-than-likely candidate for another communist assumption of state power.

In the face of such upheaval, the newly established Weimar Republic, without a Kaiser and modeled on British-style parliamentary rule, was relatively ineffective. During its 15-year reign following the first World

War, the Weimar government seemed increasingly unable to take the strong steps necessary to bring the economy under control. And the stock market crash of 1929 hit a more vulnerable Germany perhaps hardest of all. Tough management was the order of the day, and if fascists stood for nothing else, it was strong-arm control.

Facing drastic state budget cuts, the newly installed Nazi government viewed “wards of the state” as both costly and expendable and thus took eugenics to its ultimate end—sterilization and genocide. In fact, during the whole of the Nazi period, somewhere around 400,000 institutionalized persons were involuntarily sterilized; the majority of these were during the first four years of the sterilization law’s existence (1933–1937). In some areas, such as the state of Baden-Württemberg, more than 1 percent of the entire population was sterilized. However, as the war effort accelerated and resources became tighter, “euthanasia” was increasingly substituted for sterilization.

Sheila Weiss, a historian at Clarkson University, emphasized recently that from an efficiency standpoint, a racial policy such as the euthanasia program is not without its logic, as morally perverse as that logic may appear. “Throughout its history, race hygiene was a strategy aimed at boosting national efficiency through the rational management of population,” she says. “Although the extermination of millions of European Jews cannot really be viewed as a measure designed to boost national efficiency, the interpretation of the Jews as an unfit, surplus, and disposable group is not unrelated to the emphasis implicit in German race hygiene regarding ‘valuable’ and ‘valueless’ people. Hence, when all is said and done, it is the *logic* of eugenics far more than its racism that proved to be the most unfortunate legacy of the German race hygiene movement for the Third Reich.”

The advent of eugenic solutions showed that under varieties of emotional and financial duress, ordinary individuals, not just misguided or demagogic political figures, can succumb to the logic of what can be seen in a calmer light as an abhorrent solution. Indeed, according to Oxford historian Michael Burleigh, many individual families hardest hit by economic conditions in Germany were sometimes “relieved” to have their mentally ill or dependent relatives committed to institutions, sterilized, or even subjected to euthanasia, rather than persist in the expensive and emotionally draining experience of maintaining them in home care.

The whole Nazi eugenical and sterilization effort, of course, was misguided from the outset, based as it was on a simplistic notion that complex behavioral and personality traits could be reduced to single labels or categories. It could not have worked even if the “thousand-year Reich” had lived out its millennium. Germany’s problems were hardly the result of a significant increase in deleterious genes within its population.

Meanwhile, in the United States the eugenics movement declined somewhat in importance by the mid-1930s, for reasons that are complex and controversial. Most scholars of the subject agree that failure of eugenicists to keep abreast of rapid developments in Mendelian genetics was not, as formerly claimed, a major factor. Similarly, apparent links between American and Nazi eugenics in the 1930s appear to have played only a minor role in bringing eugenics into disrepute.

My own view is that the older, harsher, more simplistic eugenics of Davenport and his generation declined because it had outlived its political usefulness. With immigration restrictions in place and sterilization laws on the books in many states, the eugenics movement had achieved about as much as could be expected at that time.

Eugenics Today?

How close are we today to embracing a modern form of eugenics? Will we in the United States someday soon re-walk those paths of trying to solve our social problems with scientific panaceas? I am sorry to say that I think the answer may be yes. A new eugenics movement would, of course, be called by a different name, but an era of similar economic and social conditions and a similar political response—our current philosophy of “cost-effectiveness” or “the bottom line”—has already arrived.

Witness the decline in our own economic and social conditions in the past two decades as an indicator of our potential to find eugenical arguments (clothed in the updated language of molecular genetics) attractive once again: Average weekly earnings have fallen 16 percent since 1973, and median income of families with children (under 18) has declined 32 percent. Meanwhile, the top 1 percent of the population controls almost 48 percent of household wealth and income, while the top 20 percent controls 94 percent. Unemployment has hovered at the 5 to 7 percent figure for the past four years, and analysts complain that these figures fail to include a whole category of “underemployed” (part-time, occasional) workers, or those who have simply given up on the job market and no longer report to unemployment offices.

A parallel between the economic and social milieu of the United States today and that of Germany in the Weimar and especially Nazi periods emerges in the debates over health care. Then as now, the discussions centered on decisions about who should receive what kind of health care and for how long. Indeed, in Germany medicine was considered a national resource to be used only for those individuals who showed the greatest prospect of recovery and future productivity.

In the “cutback” atmosphere that dominates our dis-

cussions of other social policies, the mood seems similarly exclusionary and bitter. For example, legislation that proposes to limit welfare recipients to five years over a lifetime, the suggestion that welfare mothers with more than two children be given Norplant (an antifertility drug), the idea of "three strikes and you're out" (three convictions mean a life sentence), and increasing calls for the death penalty—all run a striking parallel to the mood in late Weimar and Nazi Germany that called for reduction of rations for, and later elimination of, the aged, those with terminal diseases, repeat offenders, and the mentally impaired. Such extreme measures were justified in Germany by the policy of efficiency and scarcity of resources. Our current focus on "tough love" may be just a euphemism for what may somewhere down the road become "lives not worth living."

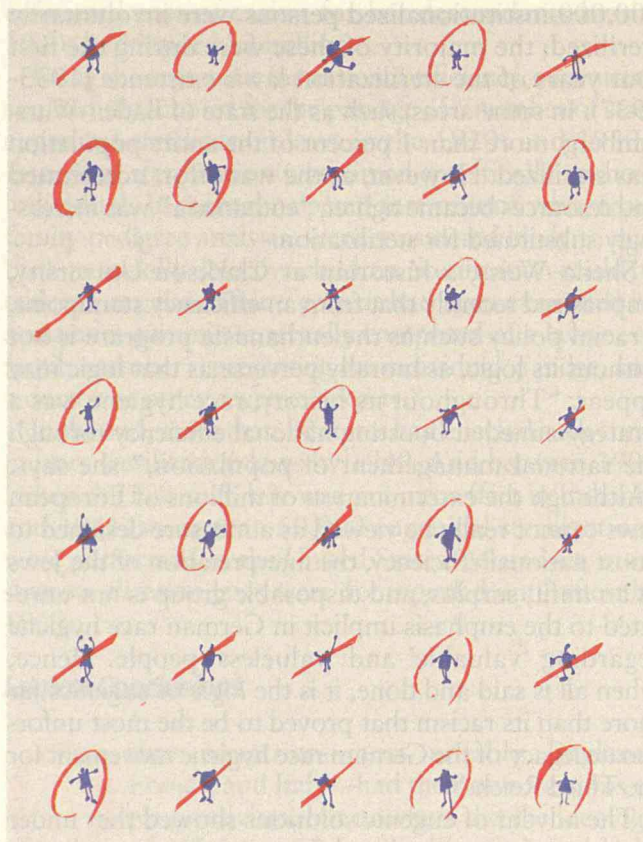
It is important not to underestimate the degree to which economic and social stress can lower our sensitivity to each other and to moral and ethical values. To a family already stressed by pay cuts, increased workload, rising costs of living and reduction in benefits, the use of tax dollars to maintain what is portrayed as a large population of dependent, nonproductive citizens is not likely to engender much sympathy. Witness the success of California's Proposition 187, which denies public services—health care and schooling, for example—to "illegal aliens."

If we are willing to contemplate severely restricting public assistance now, leaving a whole segment of the population to live at less-than-subsistence levels, is it too far a step to consider such people "expendable"? Historian of science Diane Paul of the University of Massachusetts puts it succinctly: "One clear lesson from the history of eugenics is this: what may be unthinkable when times are flush may come to seem only good common sense when they are not. In the 1920s, most geneticists found the idea of compulsory sterilization repugnant. In the midst of the Depression, they no longer did.... Over time, noble sentiments came increasingly to clash with economic demands. Charitable impulses gave way to utilitarian practices."

I do not want to sound alarmist. We are not, after all, in anything like the severe stage of economic decline Weimar Germany experienced in the 1920s. But it would also be unwise to fail to anticipate how we might respond if we found ourselves in such dire straits. Contemplating our potential for accepting fascist solutions is particularly important at a time when it might be possible to alter our course.

On another front, genetic determinism—the notion that genes have the power to determine social and personality traits such as criminality and aggressiveness—is becoming as rampant today in both scientific and lay circles as it was in Weimar Germany in the 1920s. The United States has devoted considerable resources to research on the genetic basis of many such traits. For example, the National Institute of Alco-

holism and Alcohol Abuse has allocated \$25 million for research on the genetic origins of alcoholism. The National Institute of Mental Health has awarded even larger sums for the study of the genetics of schizophrenia and manic depression. Three years ago, the National Institutes of Health (NIH) proposed bringing much of the criminality research under the umbrella of a \$400 million, government-funded "Violence Initiative" that would coordinate studies on the biological basis of violence in inner-city youth. Other recent studies have attempted to find a specific genetic basis for



conditions such as shyness, novelty seeking, risk taking, proneness to anger, impulsivity, attention deficit disorder, and the like.

Meanwhile, the publicity given to each new or preliminary report on the genetics of human behavioral traits has grown even faster than the research itself. Every major popular magazine—*Time*, *Newsweek*, *U.S. News and World Report*, and the *Atlantic Monthly*, to name only a few—as well as most major newspapers have carried stories about the newest discovery of a gene for a given disease or trait. Moreover, all the accounts have been presented against the backdrop of the Human Genome Project, whose legitimate discoveries about the location of DNA segments for Huntington's disease and cystic fibrosis, among other conditions, have lent an aura of authenticity and prestige to the general field of human genetics that further validates the more hyperbolic popular reports.

What can we do to prevent a resurgence of a Nazi-like mentality? One of the most important weapons we have is the knowledge that Nazism did occur once in recent history. Our understanding of that experience can provide powerful lessons, if we are willing to learn from them, about how simplistic science can be perverted to socially destructive ends.

We also have a far more sophisticated understanding of genetics today than did our counterparts in the 1920s and 1930s. While this knowledge does not guarantee that simplistic claims of a genetic basis for our social behavior will not be put forward, it does mean we can counter such arguments with modern facts. Indeed, researchers have had great difficulty establishing any satisfactory claim that specific genes cause complex human social behaviors. Virtually none of the studies claiming such links have been duplicated by independent researchers. And many have been withdrawn after

the relative contributions of heredity and environment in the development of special behavioral traits. If the environment cannot be controlled—if we cannot know clearly what influences acted with what intensities at all periods of development—then we have no real way of determining the relative influence of heredity and environment in the interaction.

Defining human behaviors also involves a high level of subjectivity. What is a “criminal” or “violent” act? What is alcoholism? We can make up arbitrary definitions for legal, psychiatric, or clinical purposes, but this does not mean we are dealing with behaviors that have the same causal roots. If researchers cannot agree on the nature or definition of a trait, they have little hope of rigorously studying its genetics.

Yet another advantage we have at the moment is experience, both in the scientific and lay communities, showing that open opposition to genetic determinist ideas can affect the degree to which they are accepted. Geneticists and other biologists did not stand up publicly to oppose eugenical claims in the 1920s and 1930s

Researchers are unable to verify claims that biology is to blame for complex

social behaviors—such as violence in inner-city youth—because the genes

affecting behavioral traits are the most influenced by the environment.

the first flurry of excitement surrounding their publication in professional journals.

One reason for the difficulty in verifying such claims is that the process by which embryos grow suggests that genes are not rigid bits of information that invariably lead to the same outcome. Changes in the chemical, physical, and biological conditions can turn genes on or off or change their degree of expression at critical periods in the developmental process. In this respect, the genes affecting human behavioral and personality traits, the most plastic to begin with, are the most influenced by environmental input.

The fact that today's researchers have had no greater success in rigorously establishing the genetic basis for social behaviors than did their counterparts 70 or 80 years ago suggests that the whole question is misconstrued. Although simplistic claims are still being and probably will continue to be made, trying to sort out how much genes as opposed to environment shape human behavior is ultimately a scientifically meaningless undertaking.

Such studies would be virtually impossible, given our unwillingness to subject ourselves and our children to the rigorously controlled, multigenerational experimentation that would be necessary to begin to tease apart

the way some of their counterparts are doing today. The NIH Violence Initiative might have moved into place unnoticed had not Maryland psychiatrist Peter Breggin, who is head of the Center for the Study of Psychiatry and Psychology in Bethesda, Md., made a cause célèbre of the Institute's proposal to study the biological basis of violence in innercity youth. The claims of Arthur Jensen, Richard Herrnstein, and William Shockley 20 years ago about a genetic basis for racial difference in IQ might have become quietly incorporated into mainstream biology, sociology, psychology, and educational theory had not the scientific claims been disputed publicly by knowledgeable geneticists such as Richard Lewontin and psychologists such as Leon Kamin.

Finally, and most fundamentally, if economic and social conditions ultimately determine the support and the publicity awarded to genetically deterministic ideas, then it is clear we must also work to change those conditions and create an economically more humane and egalitarian society—a desirable goal in its own right. Only by exposing the flaws of naive genetic determinism, while also attending to basic problems in our economic and social system, can we avoid repeating the worst errors of our predecessors. ■

WEEDS FROM HELL

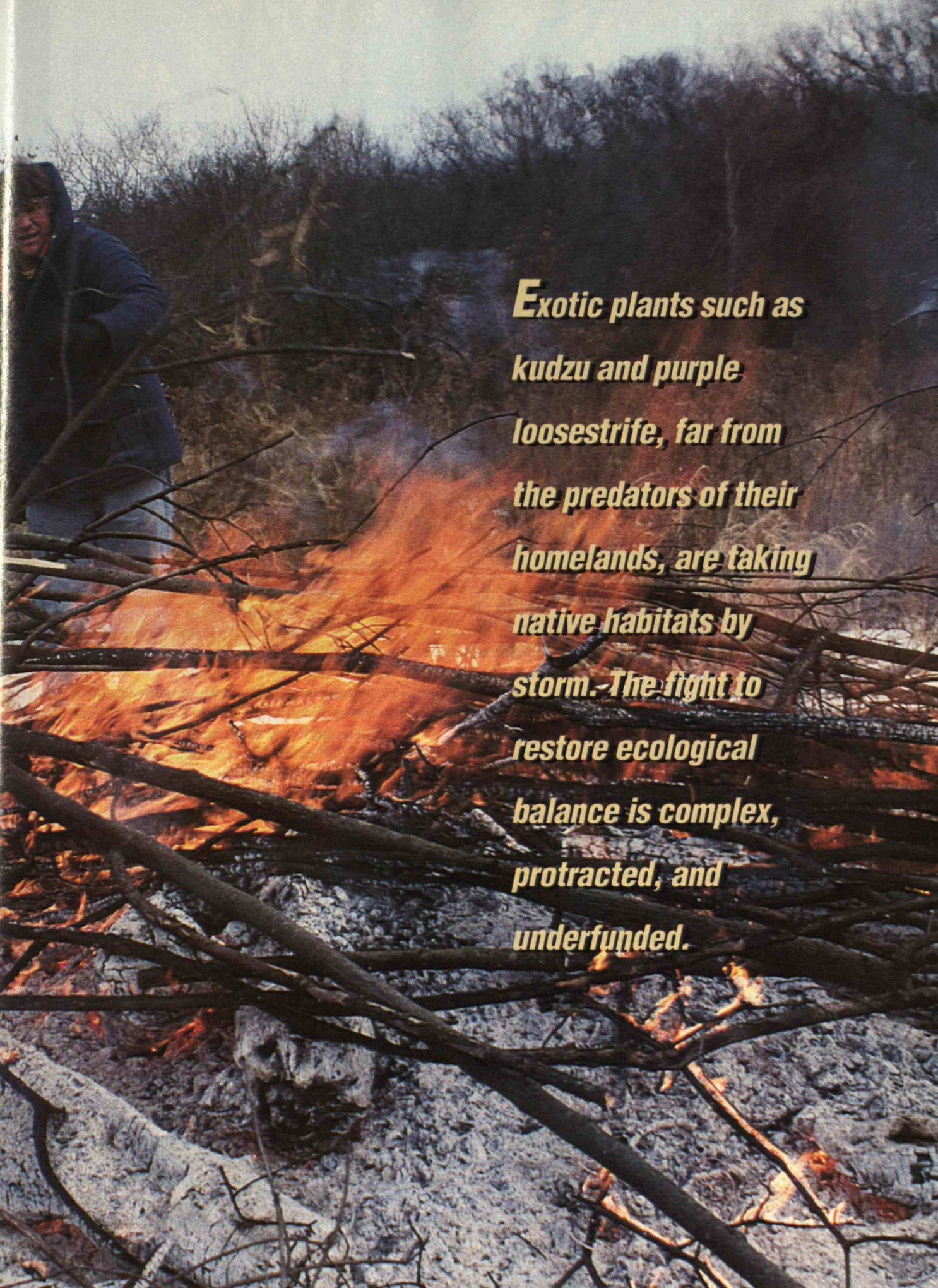
BY DAVID TENENBAUM

ON a foggy December day, near the shore of a small lake, three dozen employees of the University of Wisconsin Arboretum are attacking a weedy tree called buckthorn. As some wield lopping shears or brush saws, others drag skeletons of dead buckthorns across the snow and toss them onto a bonfire. Later, to celebrate the equinox, they cook hot dogs on the fire and recite poetry urging the pestilential tree to “go home” to Eurasia.

It's hard work, killing trees by the acre, and cold. But it's also satisfying—for the arbocidists are helping to restore a fen that, five years ago, was glutted with this phenomenally invasive weed. Even under a foot of snow, there's a stark contrast between the resurgent fen and the remnants of gloomy buckthorn thicket crowding its edges. In the thicket, the ground cover is nothing but buckthorn seedlings—not another tree, shrub, grass, or flower relieves the monotony. But on the 10-acre patch where the weed has been sawed and poisoned, 25 species of native flora—including sedges, grasses, and the endangered white lady-slipper orchid—have already returned.

PHOTO BY DAVID TENENBAUM





Exotic plants such as kudzu and purple loosestrife, far from the predators of their homelands, are taking native habitats by storm. The fight to restore ecological balance is complex, protracted, and underfunded.

Sawing, uprooting, poisoning, and burning exotic plants is a long tradition here at the UW Arboretum, where, 60 years ago, conservationist Aldo Leopold and his associates helped plant seeds for the science and practice of ecological restoration. Their aim was to recreate and preserve midwestern prairies and oak savannas—ecosystems that European settlers had practically wiped out.

In the years since, scientists here and at hundreds of other institutions have realized that a primary threat to many natural and restored ecosystems is highly aggressive, persistent, and noxious exotic plants. Strictly speaking, exotic plants are simply species that originated somewhere else; in the United States, this category includes corn, wine grapes, and the grass in our lawns. Usually, though, the term is reserved for plants that, like buckthorn, the kudzu vine, or the aquatic weed known as hydrilla, have caused problems in their new homeland. Simply put, the survival of millions of acres of land that retains native vegetation depends on victory against such invaders. “Exotics outcompete natives for nutrients and sunlight,” says the UW Arboretum’s director, Greg Armstrong. “To even hope of restoring the ecological health and balance of a natural area, you have to remove the exotics. If you don’t, you’ll end up with a solid stand of these things—and nothing else.”

And solid stands of exotic weeds are sprouting like . . . well, weeds. According to Jerry Asher, a weed specialist with the federal Bureau of Land Management (BLM) in Portland, Ore., exotics already occupy 8 million acres of the bureau’s 200 million acres. Calculating that the average weed spreads by 14 percent annually, he guesstimates that weeds are expanding on roughly 500 million acres of federal land in the West at the rate of 4,600 acres per day. An evangelist against the plague of weeds, Asher terms this “an explosion in slow motion.”

In trying to contain the explosion, Asher and kindred spirits find themselves working with inadequate resources. Public awareness is low (to many people, green land is healthy land), and the damage that exotics do to native ecosystems is difficult to quantify in terms that make politicians sit up and listen. As a result, federal support for restoration efforts has been spotty at best. Even so, restorationists are hopeful that conservation groups and other interests can mobilize to protect the remaining native ecosystems, if not make inroads into some infested areas. After all, as the buckthorn whackers at the UW Arboretum can attest, this is one problem where hand tools and volunteer hard work can make a difference.

Why Worry?

The exact dollar cost of the harm wrought by exotic plants is an elusive figure. The most comprehensive analysis of exotic species was issued in 1993 by Congress’s late Office of Tech-

nology Assessment (OTA). In a survey entitled “Harmful Non-Indigenous Species in the United States,” the OTA concluded that more than 4,000 exotics—fauna as well as flora—have become “naturalized” (able to survive without human help) in the United States over the past century or so, and that just 79 of those species cost the nation \$97 billion between 1906 and 1991—in damage to agriculture, industry, and health (primarily because exotic insects can carry disease).

Still, there is no way to reckon the dollar cost of that fragile yet priceless resource known as biodiversity. Harvard University biologist Edward O. Wilson, an authority on preserving biodiversity, says exotic invasions were probably the largest cause of extinctions through most of human history. Although Wilson says habitat loss is now a bigger factor, the problems are linked, since ecological change can open the way to exotic invasion, and invasions of exotics can change habitat as dramatically as a bulldozer—and with much less regard for a sign saying “nature preserve.”

Most biologists say that reducing biodiversity deprives natural systems of their resilience, the ability to rebound after fires, hurricanes, and other natural changes. And by definition, if we reduce biodiversity, we eliminate the components of natural systems—the species—that contain genes and substances needed by medicine, industry, and agriculture. Indeed, our reliance on ecological balance extends beyond the food we eat to the oxygen we breathe.

Even without a specific measure of the price of exotic species, perhaps it is enough to say that biologists and resource managers rank them near the top of all ecological threats. In 1995, when the Nature Conservancy, the world’s largest manager of nature preserves, asked 102 land stewards to rank threats to 550 Conservancy preserves, almost half included exotic plants among the top three problems. Carol DiSalvo, a weed-management specialist with the National Park Service, points to exotics and overvisitation as the primary threats to national parks.

Alien Invasions

In terms of sheer biological enthusiasm, the encroachment of an aggressive exotic is an impressive sight. Year after year, it takes over a piece of ground, making it more hospitable to itself and less hospitable to the competition. The worst offenders are well equipped to mount such an invasion: they typically make a lot of seed at a young age, their seeds are spread widely by animals, they can tolerate varied environmental conditions, and they can shade, chemically repel, or otherwise crowd out other plants.

Even if exotic species are just doing what comes naturally—competing in the battle for natural selection—most exotic infestations are hardly an example of “nature doing its thing.” Most of the worst exotics have been transported by human beings. Some, such as the Japanese honeysuckle vine, a bane

DAVID TENENBAUM, a contributing writer for *Technology Review* from Madison, Wisc., has chainsawed and poisoned thousands of buckthorn trees over the years in an effort to restore an oak woods near his home.



of the South, have been introduced as ornamental plants. Some have been planted as food for wildlife like deer or birds (multiflora rose forms thorny thickets in the Midwest) or for people (the strawberry guava, which forms shady, one-species thickets in Hawaii, is one of at least eight western weeds brought to that state as crops). These transplants grow unchecked because they have left natural predators and competitors behind.

An Australian tree called melaleuca demonstrates what can happen when natural stresses are absent. In their homeland, says Douglas DeVries, an exotic plant specialist at Everglades National Park, the trees "have an open, parklike spacing and are thinly foliated and misshapen." The plant falls prey to diseases and to about 200 insects, keeping ecosystems in a dynamic, healthy balance. But when melaleuca was transported to Florida for sale as an ornamental tree, the predators stayed home, short-circuiting the natural balancing act. Florida's melaleuca trees "look like arboretum specimens," DeVries says. Because the trees "can displace all native vegetation, in wet and dry areas," they now dominate 500,000 acres, and are colonizing 50 acres a day.

Florida is also being invaded by hydrilla, a water weed that has choked 75,000 acres of rivers and wreaked havoc on the recreational boating industry by clogging motors. Once imported for home aquariums, hydrilla was apparently dumped into a river by someone who wanted to grow it locally. Like many aquatic weeds, hydrilla jumps

***B**uckthorn trees grow in dense thickets whose shade prevents other species from thriving. The author (top inset) has dispatched enough of these Eurasian transplants in his own neighborhood to allow the return of wild geraniums. And on a 10-acre patch of fen that volunteers have cleared at the University of Wisconsin Arboretum (bottom inset), native grasses and sedges have begun to rebound.*

from one lake to another on boats and boat trailers.

Similar misadventures have befallen every part of the United States. Kudzu has been dubbed the "vine that ate the South" for its ability to grow up to 50 feet per year and smother everything in its path—including buildings, trees, and utility poles. Promoted as a ground cover in the 1930s by the U.S. Soil Conservation Service, the vine now occupies millions of acres in the southern states and is moving north into Illinois and Pennsylvania. Vines like kudzu can make particularly aggressive invaders, since they derive structural support from other plants and can save their energy for vigorous growth and reproduction. Another vine, mile-a-minute weed, which reached a Pennsylvania nursery by accident in a container of Asian rhododendrons, is expanding in Pennsylv-



vania and New York State. Mile-a-minute weed can grow up to six inches a day, and is forming dense monocultures that overwhelm almost any vegetation in its path.

In the Midwest and the East, garlic mustard, a white-flowered biennial that tolerates the gloomiest shade, has a "talent" that the average exotic lacks. Most invaders start their encroachment at the "edges"—along roads or borders of farmland—and work their way inward. This makes them easier to control, particularly in large blocks of forest, which have proportionately little edge. But garlic mustard can establish itself in deep, pristine forest.

Buckthorn, the green plague at the University of Wisconsin Arboretum and elsewhere in the Midwest, is a specialist at shading out other plants. The tree turns green a month before the native flora and stays green a month later in the fall, converting more sunlight into carbohydrate energy than native species. From a weed whacker's point of view, buckthorn exhibits another noxious trait—if you cut the stem, 10 new ones will spring back from the stump. Thus, to eradicate it, you've either got to uproot the entire plant or poison the stump with herbicide.

In the Northeast and the Midwest, Eurasian water milfoil, a feathery-leafed submerged plant, and purple loosestrife, a

showy wetland flower, are playing havoc with aquatic ecosystems, choking out fish, birds, and native vegetation by reducing oxygen levels, and distressing swimmers, boaters, and waterfront residents by causing an oppressive stench when they decompose.

In the West, between the Rockies and the Sierra Nevada, a Eurasian exotic called cheatgrass has carpeted 100 million acres. Unlike native vegetation, cheatgrass is highly combustible and regrows quickly after fires—so it not only fuels the flames that burn out other species but rebounds faster as well. Like many other exotics, cheatgrass seems to thrive on human intervention: it traveled around the West in livestock hair and shipments of wheat seeds. Furthermore, since it evolved in an area with large herbivores like camels and horses, it was better suited to the heavy grazing of the past century than was indigenous vegetation.

The salt cedar, an Old World species imported as an ornamental tree and then introduced to the Southwest for erosion control early in the century, has taken over the banks of streams and rivers in Arizona, New Mexico, and neighboring states. The tree's roots draw salt from below the soil and its salty leaves raise the soil salinity, retarding the growth of native cottonwoods and willows. Only two native birds have

A vast field of European yellow starthistle in western Idaho threatens native plants such as *Calochortus macrocorpus* (inset below), a rare flower found only in the Hell's Canyon area of Idaho

and Oregon. In the Selway Bitterroot Wilderness of Idaho (inset far left), the U.S. Bureau of Land Management's Jerry Asher and a hatted colleague examine part of a 40,000-acre infestation of spotted knapweed, another European import.

adapted to the thickets it creates, says Gary Cramer, a former weed control specialist at the University of Arizona who now operates Natural Resource Solutions, an environmental consulting firm in Tucson.

Although killing salt cedar is difficult and expensive, Cramer finds the idea of living with it an unacceptable defeat.

"This is down in the riparian areas [lands near waterways]—some of the most valuable areas in the Southwest," he says. "I hate to give up the fight. Can we simply accept that the cottonwoods, the willows will be eliminated?"

Weeding Out Exotics

Unfortunately, exotic infestations defy simple solution. Although an ounce of prevention generally outweighs a pound of cure, effective prevention programs are rare. For one thing, selectively banning importation requires that scientists be able to predict which new organisms are likely to prove bothersome—a difficult task, but not an impossible one, given the ability to share information around the globe.

The most aggressive approach would be to assume that any introduction could cause problems, and to ban all sales of suspect plants. Sara Stein, author of *Planting Noah's Garden*, which describes the use of native plants to help preserve endangered species, found that 20 of the worst weeds, including buckthorn, purple loosestrife, Japanese honeysuckle, and even kudzu, are still being sold by U.S. nurseries. Dan Thayer, president of the National Association of Exotic Pest Plant Councils, notes that nurseries in Florida have sold 80 per-

cent of the state's exotic pest plants and thinks the nursery trade should bear some responsibility for prevention: "The industry that is introducing these plants should have to prove that they're not going to cause a problem. It's public lands that are most threatened by exotics, and we as citizens end up paying for the control measures." But simply prohibiting the sale of foreign species would run afoul of significant industrial interests in horticulture and agriculture.

Plants with nasty reputations can be banned under the Federal Noxious Weed Act, but that's an underused weapon. The list contained only 93 species as of 1993, and ignored at least 750 species—including the widespread and destructive water milfoil and Brazilian pepper—that OTA experts said met the act's definition of "noxious weed."

A more promising solution may be early eradication. When weeds first appear, they can often be eliminated cheaply and effectively. The Bureau of Land Management's Asher says the trick is to convince the public and land managers that the first invaders are an emergency comparable to a small forest fire—something that can be controlled if confronted early. For example, Asher says, in many watersheds of the West, weeds are not yet a major problem, and between hikers, hunters, campers, and birders "there are many eyeballs out there" to spot the invaders. Early eradication is something "a Boy Scout troop can take care of on a weekend trip," Asher maintains. "It's a very reasonable management objective if you can get people educated and trained." Education efforts, he says, can be as simple as posting weed warnings at trailheads and asking hikers and hunters to report suspicious outbreaks.

The BLM has begun four early-eradication pilot projects. One, the 211,000-acre Bridge Creek Demonstration Weed Project on the John Day River in central Oregon, "will demonstrate the effectiveness of all owners and interested parties joining forces to reduce the spread of noxious weeds," Asher says, adding that the area is large enough, and sufficiently ridden with yellow starthistle and Russian knapweed, to be a significant test project. The five-year effort will try to prevent new areas from being infested and to control seed sources by killing weeds on areas adjoining pristine areas, with a budget of \$165,000 a year.

When nasty exotics are approaching the neighborhood, a good first defense may be a quarantine. For example, Everglades National Park is trying to keep melaleuca out of the park itself by controlling the tree on 122 square miles of the East Everglades Acquisition Area.

Since many exotics thrive best in conditions that humans have altered, some restorationists want to bring back conditions that favor native species. To use a medical analogy, this amounts to making the body healthy enough to resist an infection. Boosting resistance is the key to restoring scraps of the midwestern prairies, as shown by ecologists Theodore Sperry and John Curtis of the University of Wisconsin, who, almost 60 years ago, used controlled burns to kill exotics. Ironically, while this sounds like the kind of "disturbance" that weeds thrive on, the real disturbance in the prairies was the quelling of fires that the ecosystem relied on; many prairie

species need intense heat in order to sprout. Deliberate fires are now a routine part of prairie maintenance, and play a growing role in eradicating exotics from oak forests.

Another attempt to make land less hospitable to exotics is under way in Everglades National Park, where the Brazilian pepper tree occupies 100,000 acres. The infection is particularly severe on former agricultural land, where decades ago farmers crumbled a layer of rock close to the surface to make the soil higher, drier, and more suitable to crops. A few years ago, park staffers began stripping eight inches of soil from the surface of 60 acres of this land, in an effort to reverse the ecological change that favored agriculture and Brazilian pepper. In the damper, lower soil remaining, wetland species have returned, but not the pesky pepper. DeVries says such restoration "enables the area to recover and be maintained without much additional management effort." The park is expanding the technique to more than 4,000 neighboring acres, all part of a 20-year vendetta against the pest.

When weeds have established themselves, however, the control options become considerably more grim: eradicating entrenched weeds takes energy, limited expectations, and a willingness to get dirty. Small weedy trees can be uprooted with a lever device called the Weed Wrench, which grabs the trunk and pries the tree out of the ground. Girdling—or stripping the bark off a section of the trunk—will kill some weed trees that are too big to uproot. Yet many species, when sawn or girdled, resprout from the stump into a shrubby mess that's almost impossible to kill. For trees like these, the only option is to paint the stump with herbicide. Although using herbicide does not come easy to the average nature lover, treating the stump uses much less chemical than spraying the leaves, and in many cases, the choice is simple: use the herbicide, or tolerate the exotic.

Fighting Fire with Fire

If hand eradication is slow and expensive, why not restore the natural balance by importing the enemies that controlled the weed in its homeland? Identifying and importing these enemies—biocontrol—can work well, as it did in Australia in the 1920s against a huge infestation of prickly pear cactus that had been introduced as feed for cattle during a drought. But the approach can also backfire. In the U.S. Northern Plains, a seedhead weevil, *Rhinocyllus conicus*, that was introduced about 25 years ago as a biocontrol for exotic musk thistles (which started spreading from Montana), has begun moving into northern New Mexico. If they reach the southern part of the state, they could well start preying on the Sacramento Mountains thistle, a threatened native plant.

Resource managers today are divided over biocontrols. Because of a few examples like the seedhead weevil, says Cramer in Tucson, "many people are vehemently against introducing an exotic species to control exotic species." But Richard Lee, a weed scientist with the New Mexico State University Cooperative Extension Service, believes predators are now more narrowly targeted toward pest plants. If the musk thistle project were to be attempted today, he says, scientists would import an insect that was more specific to the musk thistle.

Indeed, proponents stress that modern biological control efforts rely on sophisticated testing to see whether the new organism will stray beyond the target species. In a long-standing federally sponsored attack on purple loosestrife, says Brock Woods, a plant ecologist at the Wisconsin Department

of Natural Resources, six European insects "were tested against native vegetation that you'd find with purple loosestrife, and against crops and ornamental plants." The insects variously attack the roots, flowers, seeds, and foliage of the exotic plant, he says, and "there is no indication that there will be a problem with insects switching hosts." Releases of the biocontrol were scheduled to begin in 25 states this summer.

A new wrinkle on biocontrols could be called the Darwin gambit. It's logical that, as a weed begins to dominate an ecosystem, something will evolve or immigrate to eat it. That apparently has happened to the Eurasian water milfoil, the weed that monopolizes lakes in the Northeast and Midwest. A decade ago, the weed composed 90 to 99

Many Florida waterways are so choked with hydrilla that they are navigable only by airboat. When another aquatic interloper, the water hyacinth (bottom left), saturated a Texas backwater, the U.S. Army Corps of Engineers and the Agricultural Research Service introduced South American weevils to keep the hyacinths at bay (bottom right), just as they do in their homeland.



percent of the plant biomass in Cayuga Lake, one of New York's Finger Lakes; by 1992, it accounted for only 10 percent of biomass. The sudden decline has been traced to a moth that apparently came from Europe, whose larvae prey on water milfoil. Today, says Edward Mills, director of the Cornell University Biological Field Station in Bridgeport, N.Y., "Cayuga Lake resembles the old Cayuga Lake."

This may sound like an invitation to passivity: if we wait long enough, something will come along to eat the offender. But most biologists say that, given the pace and scale of change, there is not enough time to allow evolution to readjust. The species and entire ecosystems that are being crowded by invaders may not survive that long.

Thorny Politics

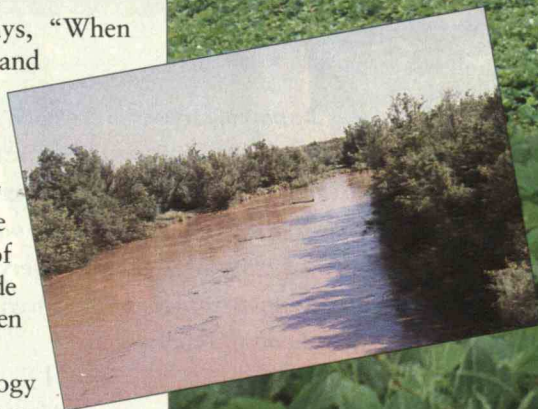
Biological controls are one area where it makes sense for the federal government to take a leading role: researching new agents and regulating their introduction is costly, government scientists have the expertise, and many of the worst infestations are on federal land. Yet money for almost all efforts to control weeds in natural areas is in short supply.

DiSalvo at the National Park Service says, "When resources are allocated, exotics are a quiet issue, and usually left to the end, even though it's in our mandate to preserve and protect natural areas." Part of the problem may be a lack of public pressure. Most people think anything green is healthy and beautiful, DiSalvo says, and although the public seems to be "slowly becoming aware of the problem, honestly, I don't know if we've made any inroads" against the misconception that green plants equal ecological health.

In its 1993 report, the Office of Technology Assessment found that programs to cope with noxious weeds on federal lands were small and underfunded. Moreover, the OTA concluded, "federal laws leave both obvious and subtle gaps in the regulation" of harmful non-indigenous species. Among a litany of shortcomings in the federal weed-control effort, OTA cited these: failure to control interstate movement of weeds that are native to part of the United States but are problematic when they reach new areas; emphasis on exotic insect and disease problems at the expense of plant weeds; a bias toward weeds that damage agriculture, not natural areas; failure to anticipate and avoid weed problems; and a lack of follow-through on previous commitments.

To this list might be added lax enforcement of existing legislation. The Federal Seed Act is supposed to prevent imports of commercial seed contaminated with weed seeds, but in many cases it is enforced too late. In 1988, for example, 58,000 pounds of lawn and pasture seed tainted with the seeds of serrated tussock, a weed that harms pasture, was sold in at least five states before the importation was halted under the Seed Act.

The OTA recommended a host of corrective measures for the problems it identified. One proposal was that plant



species be tested before being imported. Neither of two Department of Agriculture agencies—the Soil Conservation Service and the Agricultural Research Service—"systematically evaluates plant invasiveness before releasing species for use in soil conservation or horticulture." Both uses have spawned major, widespread weed infestations. Another recommendation was better enforcement of the Federal Noxious Weed Act; the OTA noted that in 1992 the Department of Agriculture's Animal and Plant Health Inspection Service had spent only \$725,000 on con-

Kudzu from Asia—"the vine that ate the South"—envelops not only trees, as shown here, but also telephone poles and buildings. Salt cedars along the Pecos River in New Mexico (inset) raise the salinity of soil, making it inhospitable to cottonwoods, willows, and other native trees.

trolling eight of the listed noxious weeds. The agency also suggested allowing for emergency listing of new weeds so as to ban the propagation and sale of the offending species.

The Clinton administration is giving exotics somewhat more attention than its predecessors. The Bureau of Land Management has requested more weed-control funding this year, up to \$1.7 million from \$1.2 million in fiscal 1995. And a Federal Interdepartmental Committee on Managing Noxious and Exotic Weeds has been established to coordinate the government's approach, with membership from the Fish and Wildlife Service, the Forest Service, the Bureau of Land Management, the National Park Service, and other land management agencies. At a series of meetings, the committee has been "trying to visualize a national strategy," says Faith Campbell, who directs the Washington office of the National Association of Exotic Pest Plant Councils. Campbell expresses guarded optimism: the interdepartmental committee could accelerate the federal effort, she says, so long as the participants actually have "the ability to commit their agencies to do things." At the same time, Campbell calculates that the feds are spending less than \$30 million on exotic species research, control, and eradication. Divided equally over roughly 726 million federal acres, that comes to just 4 cents per acre.

Some observers despair at the prospect of relying on government support. Tucson's Cramer, who studied the federal fight against weeds for his doctorate from the University of Arizona, eventually figured out that no such effort existed in Arizona, period. Today, when it comes to controlling the salt cedar, that scourge of southwestern riverbanks, he says government agencies are spending almost nothing. Cramer is looking instead to the public at large. "This may be a good example where the only viable strategy is a concerted control effort" involving youth groups and nature lovers, he says.

Other land-management experts share Cramer's belief that success against weed infestations may depend on citizen action—that committed outsiders may be the most effective weed warriors. At Nature Conservancy restoration areas near Chicago and at Cosumnes River Preserve, south of Davis, Calif., volunteer weed whackers have transformed the land-



As part of an early-eradication effort, Everglades National Park crews are trying to eliminate stands of Australian melaleuca trees that are encroaching on the park. After toppling the trees, the workers paint the stumps with herbicide to prevent new shoots from sprouting.

scape. At Cosumnes—where volunteers are restoring a riverside oak forest and seasonal wetland by eradicating invasive species and planting trees—the most energetic volunteers are invited to join a group called the Hard Corps. "It's an honor to be asked," says John Randall, the Nature Conservancy's weed-management specialist. "A lot of folks fell in love with the place, they're very strongly attracted to the land, and if you give them the opportunity to do really valuable work, they respond."

But how does one define success in a war against something as pervasive and intractable as weeds? Here, the perfect may be the enemy of the good, suggests Jack Ewel, director of the Institute of Pacific Island Forestry in Honolulu. "We may have to settle for 'para-restoration,' for a system that is heavily dominated by natives" but not purely native—an approach that could work in areas where the exotic species lack the heavy and quick seed production that marks real invaders. And some species can never return, even to restored ecosystems, he says: "We have lost pieces of the puzzle."

Nevertheless, the human fingerprint on many exotic infestations is so conspicuous that people have a responsibility to make their best effort at remediation, argues William Jordan III, secretary of the Society for Restoration Ecology. "When we move into wild areas," he says, "we create an ecological disturbance that tends to fill up with weedy species." The lesson of the prairie restorations that Aldo Leopold and his colleagues started in the University of Wisconsin Arboretum 60 years ago, Jordan concludes, is that "you have to keep working with these lands to compensate for the effects that people have on them. We're the caretakers."

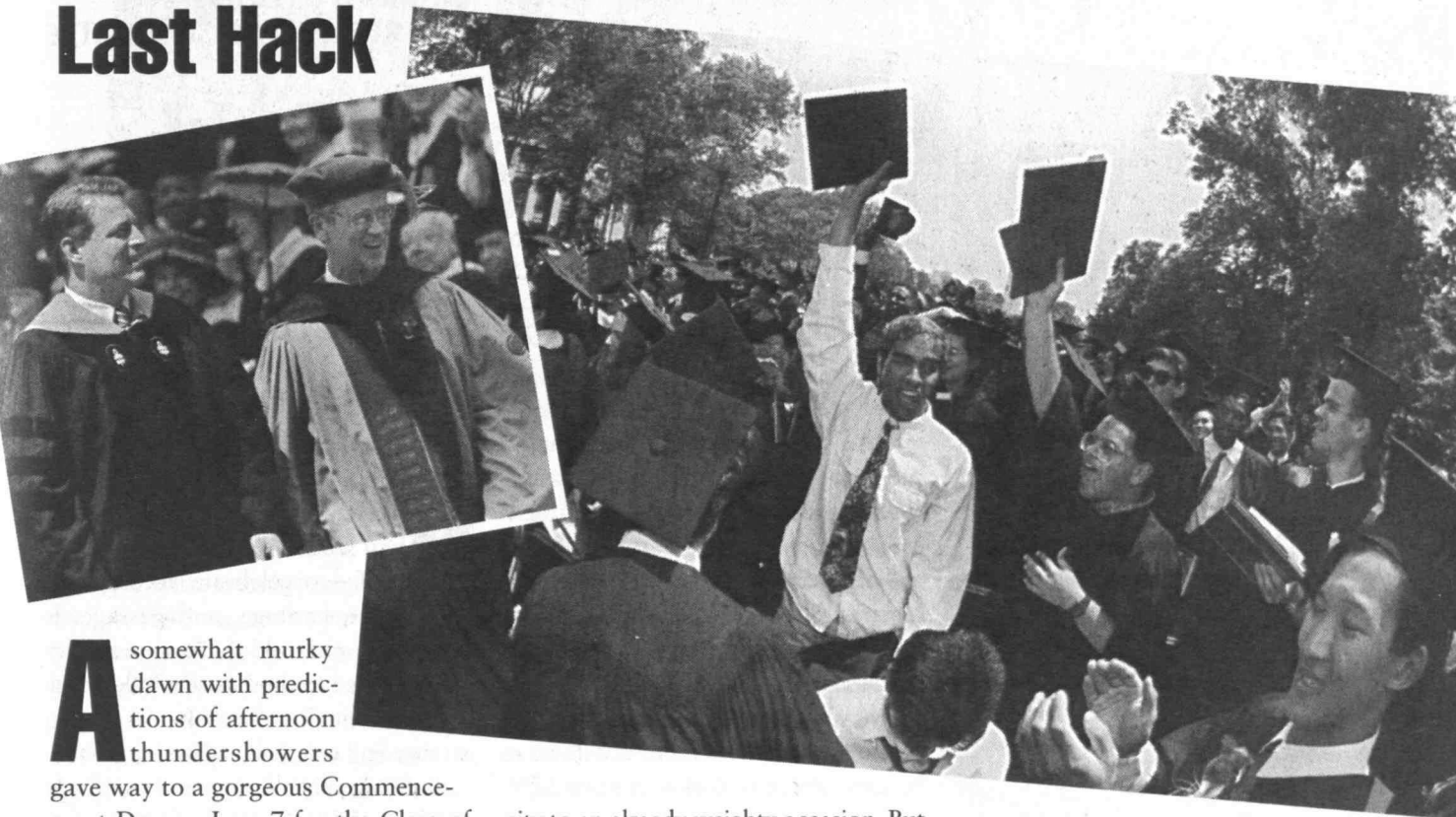
One of those caretakers, Jack Borders, is a retired state employee who has been whacking weeds at the arboretum for several years. Standing in the December snow, lopping shears in hands, Borders explains why he's on the front lines: "I like the fight. And when I finish, I want the land to be better than it was when I got here."

As Borders well understands, the war against weeds takes doggedness and a long-term perspective. Paradoxical though it may seem, if we want our natural areas to have the species diversity and scenic beauty they deserve, we must give nature a hand. ■

MITnews

FROM THE ASSOCIATION OF ALUMNI AND ALUMNAE OF MIT AUG/SEPT 1996

Record Number of Degrees. . . and One Last Hack



A somewhat murky dawn with predictions of afternoon thundershowers

gave way to a gorgeous Commencement Day on June 7 for the Class of 1996. And if the festivities didn't follow the timetable down to the minute, who could complain? After all, the reason the ceremony was longer than planned was that the vice-president of the United States and the spokespersons for the graduates had longer remarks than expected, topped off by the fact that MIT had over 200 more students participating in the ceremony than last year, making the 1996 a record year for numbers.

The conspicuous presence of the Secret Service and extra police, mandated by the appearance of Vice-President Al Gore as Commencement speaker, only served to add weight and solemnity to an already weighty occasion. But the security arrangements were simplified by having the vice-president enter Killian Court directly from President Charles Vest's office, after the graduates were in place, rather than march in the traditional procession down Massachusetts Avenue and Memorial Drive.

Gore's address, which drew a standing ovation from the graduates, was his own take on the gulf between C. P. Snow's "two cultures." Gore's speech was buttressed by his extensive acquaintance with modern technology, rendered even more extraordinary by frequent quotations from graduating seniors. The student input was taken from some 100

Several of the key Commencement players, from left: U.S. Vice-President and speaker Al Gore; MIT President Charles Vest; graduates of 1996.

responses he received to his e-mail call for their comments on the state of the world they were about to enter, and in particular on the technological changes they personally consider "the most exciting/threatening." (The full text of Gore's address and Vest's charge to the graduates follows this summary.)

Vest also gave the graduates a substantial message to chew on, as he called on them to exercise boldness tempered

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Heads Up, Newsweek

When Newsweek published on April 29 a group of articles on the high cost of attending—and running—a university, it raised a number of important issues. But it also made a number of errors, at least insofar as it discussed MIT. In an effort to curtail a deficit, Newsweek wrote, MIT is “downsizing,” and “hopes that 1,400 employees, including nearly 300 tenured professors, will take a buy-out.” While 1,400 employees were eligible, as President Charles Vest noted in his May 13 letter to the editor, only about 78 faculty and fewer than 600 other employees are expected to take advantage of early retirement incentives. Further, the departure of some senior faculty will signal openings for new, young faculty—not a reduction in overall size of the faculty, as reported by Newsweek. What’s important here is that by trimming non-faculty staff and providing intellectual renewal through young faculty, MIT will help to strengthen its educational product and solve its budget problems without increasing the pressures on tuition that Newsweek so rightly bemoans.

—SUSAN LEWIS

Commencement 1996

continued

by generosity of spirit in designing lives that will serve their country at the same time they satisfy their own lust for achievement. Vest was particularly topical in his concern about the tendency to blame social ills on immigration, and he noted the essential contributions of scholars and scientists from many lands to the greatness of MIT.

A few members of the Class of 1996 headed off any threat of excessive seriousness about the proceedings by staging a final hack: they passed out “Al Gore Buzzword Bingo” boards as students arrived to form the procession. Given the vice-president’s call for e-mail input, the students apparently anticipated—correctly—that “distributed intelligence” would be one of his themes. “We will greet him with a “Distributed Hack,” their instructions read. Designed to capitalize on “the tendency of non-technical people to use buzzwords when discussing technical issues,” the 25-square cards included an array of “buzzwords,” such as “information marketplace” and “user-centered.” Gore was evidently in on the joke, and, to his credit, nobody “won,” which would have involved crossing off five words in a row as he used them.

In the end, the ceremony got down to business: the presentation of some 2,290 graduate and undergraduate degrees to 2,009 students from MIT’s 5 schools and 21 departments. MIT doesn’t give honorary degrees; the only way to get one is to earn it. Even Winston Churchill was made an “honorary lecturer” when he spoke at MIT in 1949, not an honorary graduate. And if it isn’t easy to win an MIT degree, it’s not particularly easy to distribute them, either. Provost Joel Moses, PhD ’67, whose job it is to hand out the correct degree and shake the hand of each graduate-degree recipient, has been heard to remark glumly about what this ceremony does to his back. A logistical nightmare and a test of stamina for participants and spectators alike, MIT’s

traditional practice of presenting the correct degree or degrees (some students earn more than one) to each graduate is one of the features that distinguishes it from other institutions of its rank. □



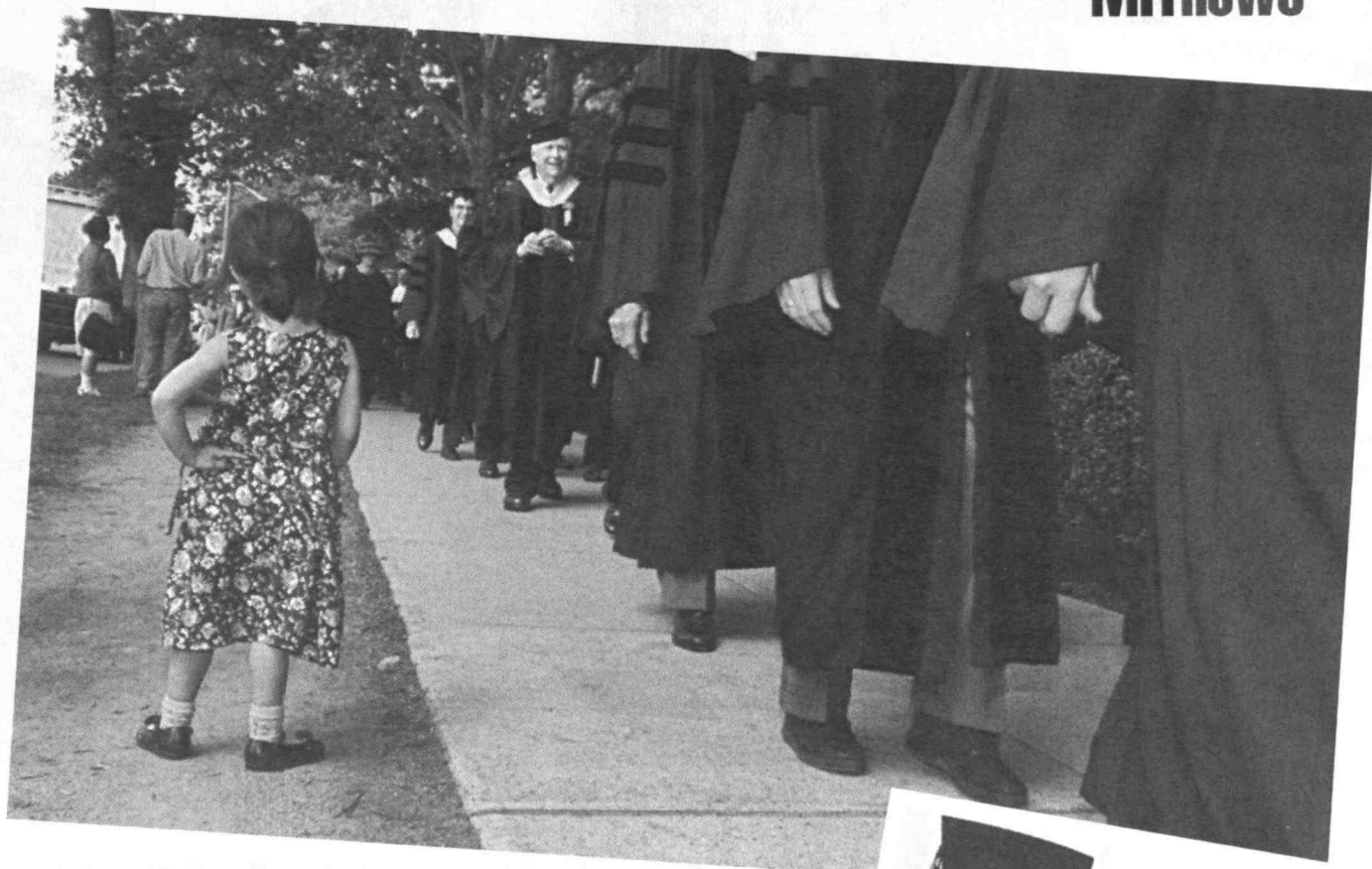
PRESIDENT VEST'S CHARGE TO THE GRADUATES

Be Bold, Open, and Generous of Spirit

Once again we are gathered in Kilian Court—the Great Court of MIT—to celebrate accomplishment, heritage, and passage. It may seem a bit odd that a community so dedicated to the future would come together on this occasion dressed in strange and colorful medieval regalia.

But indeed it is fitting, and seemingly fulfilling of deep human needs, that such rituals take place. They remind us of our role in an unbroken, centuries-old chain of discovery, learning, and accomplishment—achievements of mind and of spirit. And above all, this ceremony celebrates *your* accomplishments during your student years.

I would like to take a moment to recognize some other special graduates of MIT who are with us today. They are the members of the Class of 1946—the 50th reunion class—and the Class of 1971, celebrating their 25th reunion. You will recognize them by the red or gray jackets they are wearing—along with a certain look of wonder that time



has passed so quickly since they were in your shoes.

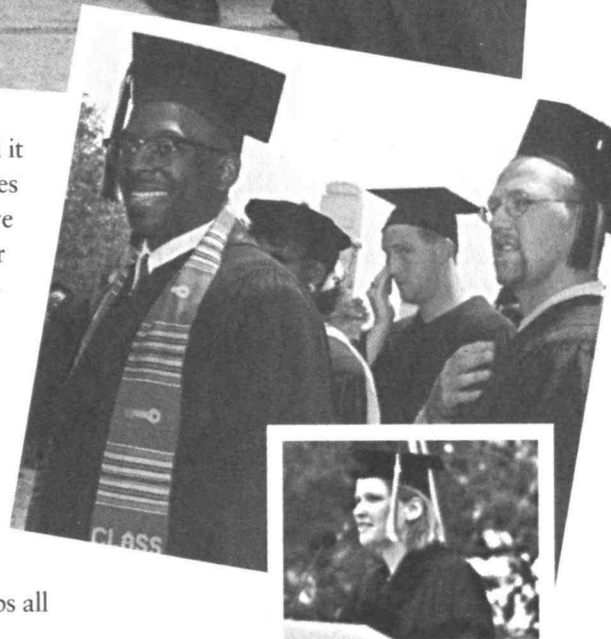
Time *has* passed quickly, and it has brought extraordinary change along with it. 1946 was a momentous year—the first post-war year. America had defeated the Nazi tyranny—a tyranny so absolute and terrible that the Class of 1996 probably finds it difficult to reckon. In 1946, the United Nations held its first session, and America was poised to build a new era and a new nation—a nation whose boldness of spirit and accomplishment would prove to be without historic precedent.

In 1971, we were in the throes of another war, the Vietnam War—a conflict that caused this nation, and this campus, to question our beliefs and each other. We were still struggling over civil rights, and the second wave of women's rights was gathering force. It was a time of great strain in society, a time of challenging the old order, and a time of dreaming the new.

Today, in 1996, we live in an age that seems to reject bold thought and bold

action. This is true in America, and it is true in Europe. Why is this? Does boldness come with a price tag we can't afford? Does it imply excess or waste or impracticality? Are we too cynical to embrace visionary new ideas? Have we turned from boldness because such vision and action usually call for shared commitment, and we only care for what affects us personally and immediately? Is this a natural outcome of our maturation as a nation and as a society? Perhaps all of the above.

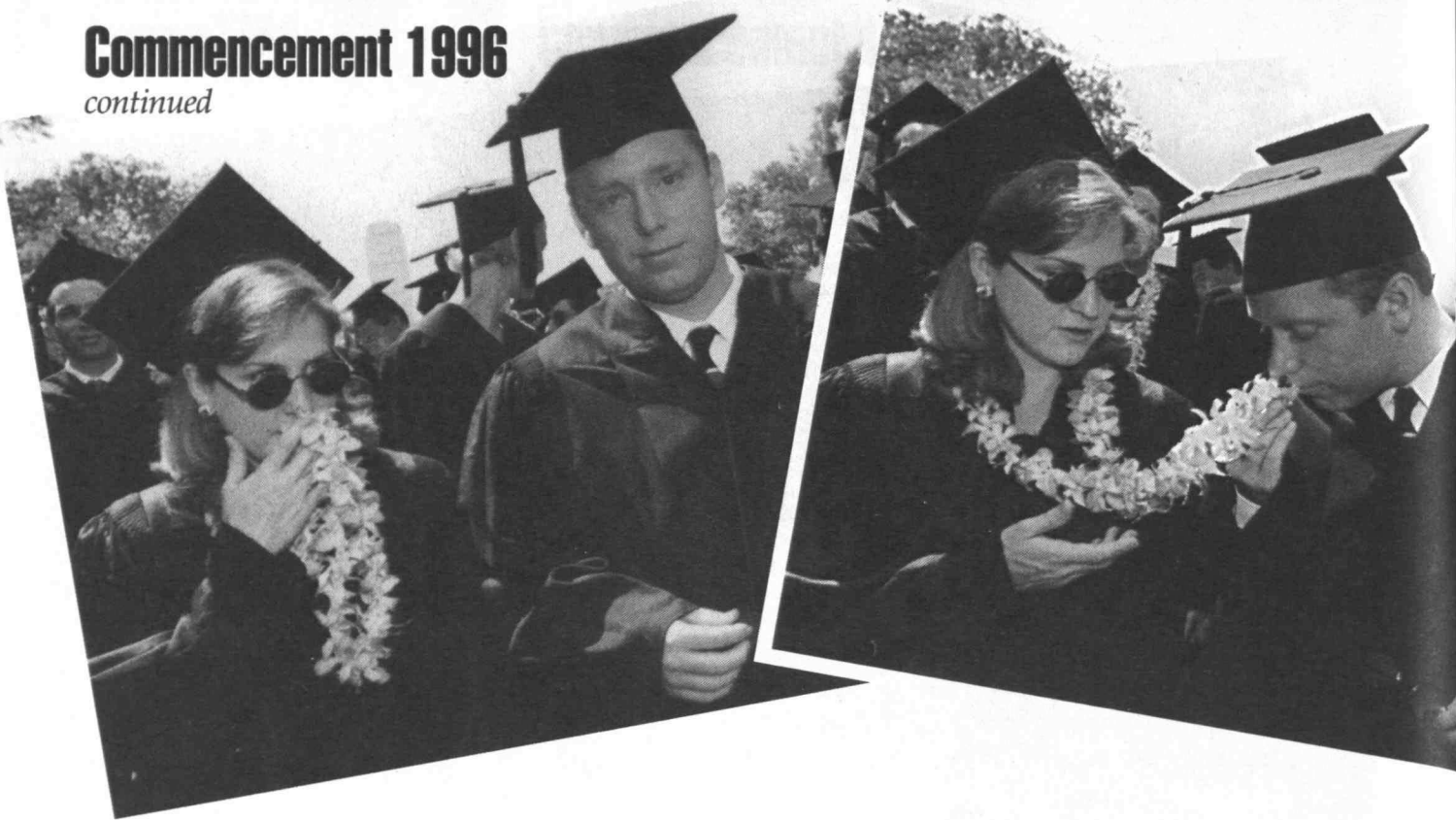
One major scientific project illustrates the point: A decade ago the United States committed itself to constructing the Superconducting Supercollider, a huge new particle accelerator. We invested over two billion dollars, and brought the project almost halfway to conclusion. Then we simply changed our mind, walked away, and left a rusting hulk in the arid Texas desert: Too expensive.



Two graduates stood out in a sea of robes interspersed with small children. Above left, in the distinctive scarf of his fraternity, Alpha Phi Alpha, is Matthew Turner, president of the Class of '96, who presented the class's gift to MIT: pledges and gifts toward a \$69,000 Public Service Fund. President of the Graduate Student Council Barbara Souter, above right, delivered a salute to MIT on behalf of her peers.

Commencement 1996

continued



Repeatedly we have set goals to be met by our schools by the year 2000, just four years hence, goals that call for our students to be first in the world in science and mathematics achievement and for every school to be free of drugs and violence. But few seem serious about accomplishing this: Too ambitious.

In the 1960s, we determined that we would build a society in which race would no longer matter and that we would make the necessary interim commitments until we reached our goal. But we seem to be backing off right and left: Too ideological, too uncomfortable, too difficult.

Boldness, staying power, and sacrifice for a greater good are in short supply. Some of the reasons, at least superficially, are apparent:

- We need to balance the national budget so that future generations will not be burdened with our debt. *Fair enough.*
- Our corporations must become more productive—doing more, and doing it better, with fewer people—if

they are to survive and succeed in the international marketplace. *Also fair enough.*

- Education is difficult in a society that is divided along economic, social, and racial lines. We can't afford to do it right for everyone. *Well, that is not fair enough.*

The state of education in America is simply unacceptable. We must correct it. We must recognize that poverty of spirit and poverty of values, even more than financial poverty, are at the heart of this crisis. And we must, as a society, resolve to act. Just as we cannot saddle the coming generations with our debt, neither can we saddle them with our lack of investment in their future. We must invest in that future—through education, through research, and through attaining common purpose.

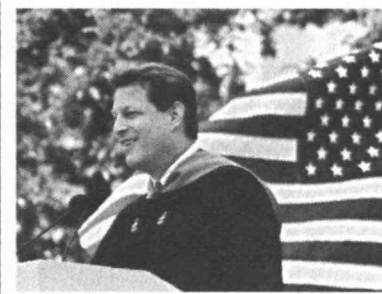
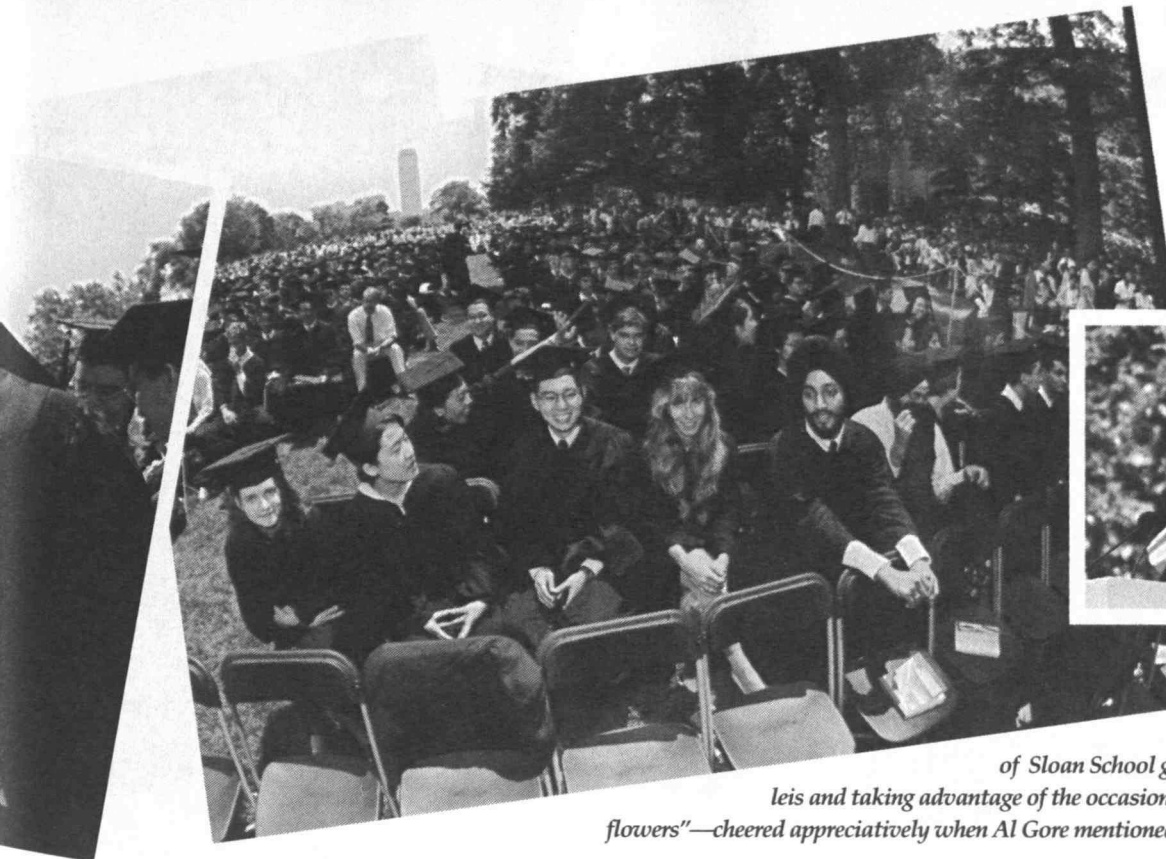
Now it is time for you to recognize the opportunity before you. You must return to a boldness of thought and action. You must take up this challenge. And in so doing, you must be open—open to new ideas and to new people. You must

develop a new generosity of spirit.

These are economically difficult times in America—at least relative to our aspirations and to the post-war boom years. And as times get tight, there is a natural tendency to turn inward. So once again, we hear concerns that we should not be educating so many foreign graduate students. We hear that immigrants are a major cause of our woes. And we keep pulling apart into homogeneous groupings of one sort or another. But just because these are natural or understandable tendencies does not make them right.

America has always been a nation of immigrants, and we have always been a land of opportunity. These statements perhaps sound quaint or old-fashioned, but they are true, and we must retain their spirit.

Each year, my wife Becky and I host a dinner in our home for the men and women who are retiring from the ranks of tenured faculty at MIT. These are always extraordinary assemblages of talented and accomplished colleagues—people who have defined MIT, and who have defined their professional and schol-



The impressively large contingent of Sloan School graduates—many sporting leis and taking advantage of the occasion to “take time to smell the flowers”—cheered appreciatively when Al Gore mentioned the school in his address.

arly fields. No lack of bold thought there!

Yet, as I survey that room each spring, I realize how much MIT, and, indeed, America, have benefited by openness to those from other countries and how wise has been our tradition of selecting and advancing people on the basis of their talent and accomplishment rather than their wealth or nationality. Openness and meritocracy are what have made MIT great, and you must continue that spirit and philosophy in your life endeavors.

Take what you have brought here, and what you have learned here, and put them to work:

- Pursue the challenge of educating America's children with the zeal and staying power that you have exhibited in the Cambridge schools and in Washington, D.C.
- Stop the retreat from bringing minorities into the mainstream and into the leadership of our nation.
- Bring the entrepreneurial spirit to America and the world that you have exhibited here in the 2.70 Design Contest and the \$50K Contest.
- Create the products, the jobs, and

the industries of the future. And while you're at it, remember that you must invest in innovation and the development of new knowledge for the next century, not just for the next quarter.

• Bring the boldness of thought and accomplishment to science, technology, and society that you have brought to your MIT research projects. Make our environment healthy. Prevent and cure disease. Rebuild our cities and renew our sense of community. Continue the great adventure of understanding the world around us.

So this is my charge to you: Be bold; be open; be generous of spirit. You have before you a new century, and an infinitely interesting and challenging world. The situation is complex and chaotic, but opportunity is everywhere.

As my favorite philosopher, Pogo Possum, once observed: “We are surrounded by insurmountable opportunity.” But then, he wasn't speaking to MIT graduates. *You* can surmount it.

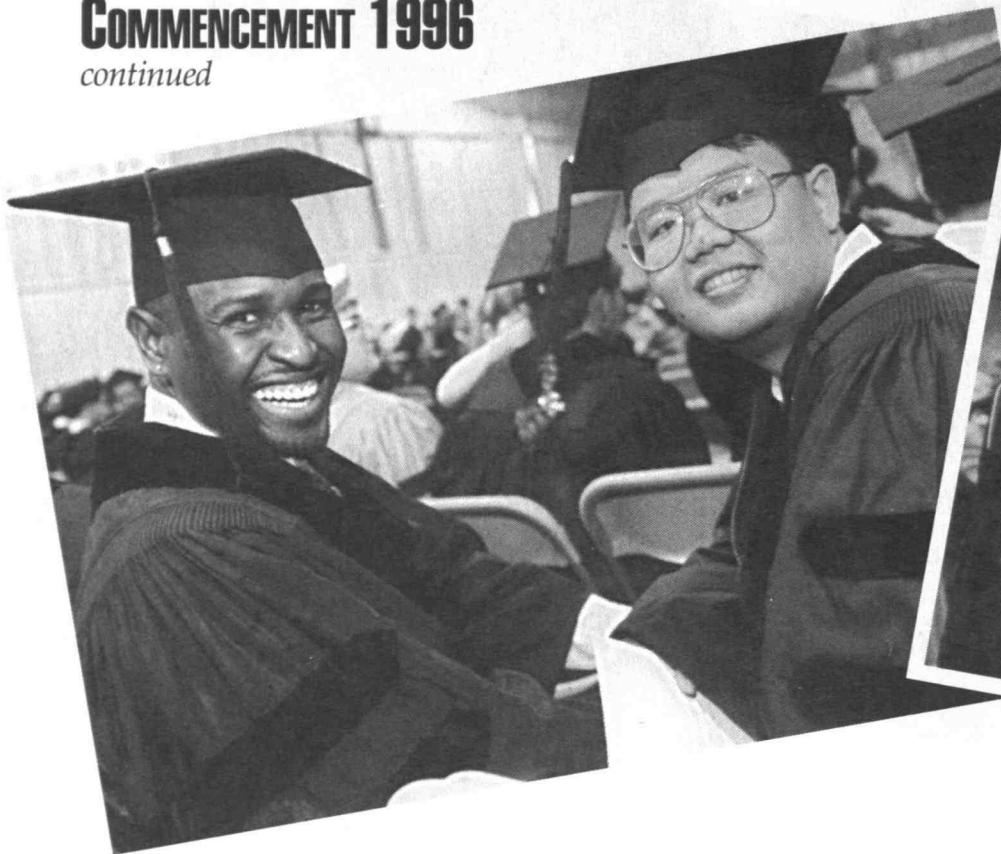
Men and women of MIT, I wish you godspeed and great good fortune.□

Gore Sees Growing Need To Unite “Two Cultures”

(Following is the text of the Commencement Address presented by Vice-President Albert Gore)

It is truly an honor to be MIT's Commencement speaker, and a pleasure to return to this city where I myself graduated 27 years ago, from a school just up the river.

That school, Harvard, and MIT have had a long and sometimes tumultuous relationship. In the early days, in the 1860s, Harvard tried to absorb MIT. But this school's founder and very first president, William Barton Rogers, fought back. He was adamant that an institution devoted to fostering scientific



knowledge and a liberal education must remain independent.

Many things have changed since those days. For example, tuition for first-year students in 1866 was \$100. (President Rogers, incidentally, literally gave his life for this institution. When he returned after his retirement to deliver the Commencement speech in 1882, right in the middle of his speech, he died. As a result, I have the rare comfort of knowing that whatever your reaction today, I will not be remembered as the stiffest speaker in your school's history. I am fully prepared, however, to be remembered as the second-stiffest.)

In preparing for this speech, I engaged in a dialogue with the graduating class by way of the Internet and your university's computer network, the Athena system. More than 100 of you responded in some detail, and I thank you very much. (For those of you who didn't respond, I know who you are.) I read every response thoroughly—on the World Wide Web—and I learned a great deal. Among other things, several of you emphasized the fact that MIT not only educates scientists and engineers but also

architects, linguists, designers, economists, even poets. Nevertheless, because this is MIT, I would like to share some thoughts today about the relationship between science and technology on the one hand and humankind and society on the other.

Widening Schism

When Winston Churchill spoke here in 1949, he spoke about the relationship of science and society. Ten years later, in a celebrated lecture in England, scientist and writer C.P. Snow introduced the concept of the "two cultures." In his subsequent book, he wrote that the culture of science and the culture of society's literary arts "had almost ceased to communicate at all." He noted that the popular culture in England and America spoke the same cultural language. But both, in his words, "had about as much communication with MIT as though the scientists spoke nothing but Tibetan."

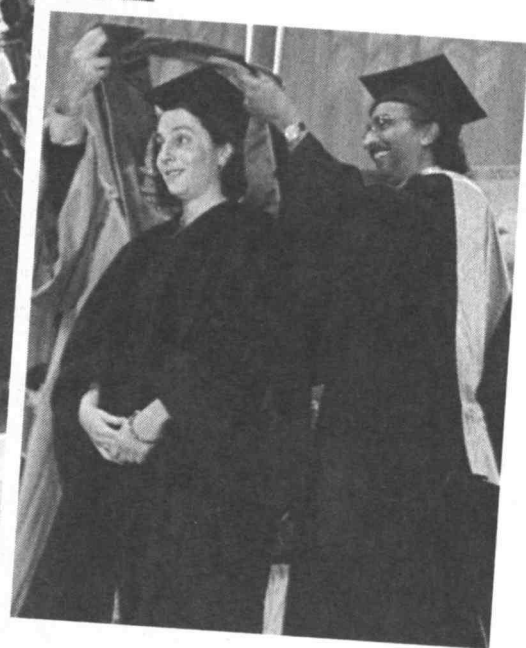
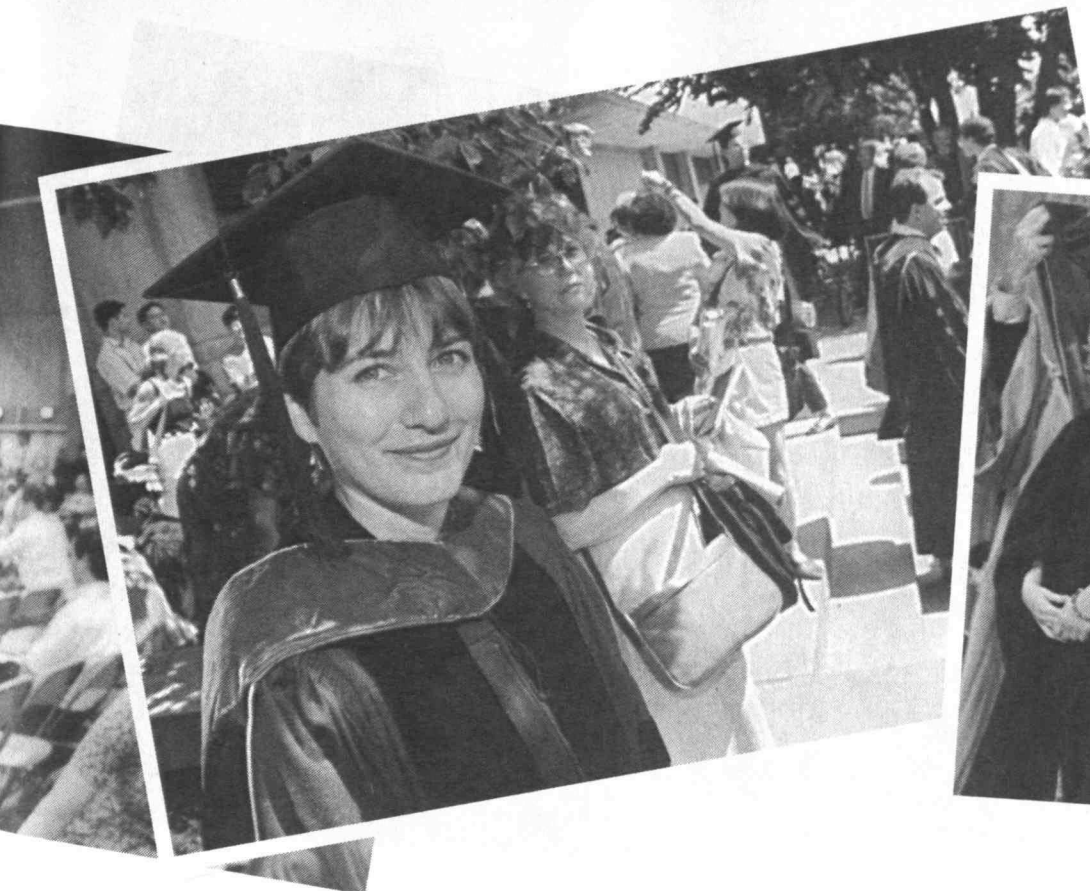
Why is there such a gulf between science and society?

This schism between science and the

rest of society—which began at least as early as Galileo's trial in 1633 and continued with the trial of John Scopes in my home state in 1925—has not narrowed since the publication of Snow's famous book.

Indeed, 18 months ago, Sheila Tobias examined this schism and concluded that it has grown worse. "Science illiteracy has entered a second, more pernicious stage, fueling widespread opposition to science," she said. She noted that physicist and science historian Gerald Holton has written that this new opposition to science "threatens to topple the Enlightenment-based tradition on which scientific discourse and democratic politics are based."

Two cultures separated by a great divide. One of the consequences of the widening of this divide is that the metaphors of science are no longer migrating into our popular culture at the rate they once did. In the early decades of the scientific revolution during the 17th century, there was an explosion of new metaphors that crossed the permeable boundary between science and culture. It was more common in that era



for individuals to be fully conversant in both science and the rest of culture. There was less to master before the scientific revolution speeded up. John Stuart Mill was once described as "the last man to know everything." In that age, people generally acquired an intuitive sense of Newtonian physics, and spoke of the universe as an apparatus that ran like clockwork. They spoke of social organizations resembling machines. Later on, Charles Darwin's theory of natural selection supplied metaphors for competition in economics and life, and still later supplied the language for a social movement that misused his theory and borrowed his name.

But now, in the second half of the 20th century, while the number of new discoveries flowing out of the still-accelerating scientific revolution is at least a thousandfold greater, the flow of these metaphors into the rest of society has slowed to a trickle.

I believe it is time for a new effort to build bridges between these two cultures. I agree with my late friend, Jerry Wiesner, who said in his inaugural

address as president of MIT in 1971, "It is our responsibility to understand what our learning and discoveries may do to man and society, and to transmit that knowledge to new generations—to . . . leaders who may be wiser than we in applying it, or wiser in judging how slowly or rapidly these technologies may be absorbed."

Applying Metaphors

I am convinced that a more robust discourse between science and society could empower us to fruitfully apply some powerful new metaphors from science in an effort to better understand society and the relationship between the society and science.

Let me illustrate what I mean with an example. I have a friend who's an MIT graduate, Danny Hillis. A few years ago, he patiently explained to me the workings of a massively parallel supercomputer by pointing out that the first computers relied on a central processing unit surrounded by a field of memory. To find the answer to a particular problem,

Following a special "hooding ceremony" the day before Commencement, doctoral degree holders were readily identified by their colorful trappings of velvet and silk—to say nothing of a hint of relief and celebration.

the CPU would send out to the field of memory to retrieve data, then bring it to the center for processing. The result would then be placed back in the memory. Three trips, back and forth, consuming precious time and generating unwanted heat.

The architectural breakthrough associated with massive parallelism was to break up the power of the CPU and distribute it through the field of memory field in the form of smaller, separate processors, each co-located with the memory it processes. When a task has to be performed, all of the processors begin to work simultaneously and process a small quantity of information, and then the separate parts of the answer are brought simultaneously to the center, where they are assembled. One trip. Less

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continued



time and heat.

When you think about it, the metaphor of massive parallelism, or “distributed intelligence,” offers a nice explanation for why our representative democracy is superior to a governmental system run by a dictator or a king. Where totalitarian regimes rely on a central processor to dictate all commands, representative democracies depend on the power and insight of people spread throughout the society, each located adjacent to the part of society in which he or she is most interested.

Or take capitalism. The Soviet Union’s economy collapsed because it relied on a central processor to make all economic decisions. It didn’t work very well. Innovation withered and corruption took root. The North Korean economy continues to rely on a central processor, and today its people are starving. But capitalist economies distribute the power to those located outside the center—entrepreneurs and consumers, who make their own activities independent of one other—and those accumulated decisions create a stable system

that marries supply and demand and keeps prices stable.

To take a third example, many of the latest techniques from the world of management—as graduates of the Sloan School know very well—rely on the same principles of distributed intelligence, even if they don’t call it that. By distributing intelligence and information and responsibility to workers on the front lines, organizations are transforming themselves, serving customers better, and producing greater value.

Each of these examples relies for its success on the same basic architecture. Instead of insisting that all decisions be made in a single place, the power is widely distributed throughout the organization. Each individual’s portion of the answer is then assembled as part of a collective conclusion. In capitalism, it’s called supply and demand; in representative democracy, it’s called self-determination. In each case, it is essential that all the individuals involved share some basic characteristics: for example, the freedom to obtain information that flows unimpeded throughout the system.

In organizations that are based on this design, it is crucial that all the individuals who are part of the organization feel a sense of cohesion that is based on a common understanding of the organization’s guiding vision. It is crucial that they all understand the organization’s basic goals, and that they all share the same basic values upon which to base a decision, whether made by the CEO or a clerk behind a word processor.

Some organizations find this cohesion deceptively easy to establish, simply because they’re new; everyone involved has been present at the creation and is eager to accomplish goals easily kept in mind until the initial burst of enthusiasm wanes. For example, NASA put a man on the moon and returned him safely in less than 10 years. It was an inspiring sprint. But once that goal was achieved, the organization’s culture began to quickly erode and has had to be painstakingly rebuilt. Likewise, some of the institutions of government created in the burst of enthusiasm we called the New Deal were remarkably successful until the first generation of managers



What can we say? They speak for themselves.

passed from the scene, and then we began to see bureaucratic rigor mortis set in.

The challenge for any organization is not simply to establish these conditions and gain the advantages of distributed intelligence, but to nurture and sustain this creative state. There's no better example of how to do that than the U.S. Constitution, with its checks and balances and careful design intended to sustain the creativity of self-government, even after more than 200 years. Our Constitution is, in a sense, the software guiding the operations of a massively parallel system for processing political decisions.

Sustaining Creativity

Our founders rejected the idea of a pure democracy, not, as some suppose now, because the information technologies of the 18th century simply could not accommodate a plebiscite on every question. Rather, as the Federalist Papers make clear, they insisted upon the importance of a reflective process, with

an intermediate institution placed between the people and the exercise of power—an institution capable of reasoned debate and deliberation, which would cool passions and distill judgment and look beyond the present moment to the future consequences of the decisions made.

Many people feel that valuable processes like these in our society are threatened by the still-accelerating scientific revolution. They wonder, for example, about the impact of television and 30-second commercials on our ability to be deliberative and reflective in our political decisions as a nation. Passionate beliefs held by a temporary majority, when powered by the extra force of new technology, may not be cooled or slowed down at all by the institutions of our self-government.

This concern that science and technology now regularly unleash forces that threaten to seriously damage some delicate balances important to the fabric of society is one of the principal issues our society must resolve in order to establish a healthier relationship between the

two cultures.

Until recently, this dialogue was difficult to begin because of a philosophical preference in the scientific method for narrow specialization, which often resulted in the splitting of large questions into smaller and smaller component parts, each of which was then analyzed by expert specialists—independently of those studying the other component parts. Not only was communication difficult between scientists and generalists, it was difficult between specialists in one field and specialists in another. The often-frustrating result was a tendency to ignore important relationships between the different parts that made up a whole. As Goethe said, in anger and frustration, "How often do they strive to divide that which, despite everything, would always remain single and whole."

In more recent decades, there has been a new appreciation within science for the study of whole systems. Here at MIT in the early 1960s, for example, the System Dynamics Group was founded by Jay Forrester, [then] a professor of electrical engineering. The new emphasis on

Commencement 1996

continued



systems creates new possibilities for a fruitful dialogue between the two cultures. For example, both cultures can describe how the invention of nuclear weapons radically transformed the age-old habit of war. The destructive consequences of all-out war between superpowers became unthinkable, and a “cold war” emerged in its place.

In the same way, a large cluster of new technologies that have enhanced our capacity to exploit the earth for sustenance has radically transformed the relationship between humankind and the global environment. For example, the air we are breathing right now in this Great Court contains six times more chlorine atoms in each lungful than it did when these buildings were constructed. The same is true of the air at the North Pole and the South Pole and the equator and everywhere on earth. The concentration of chlorine in the entire atmosphere has increased sixfold in only a few decades because of a single family of chemicals invented in the

1930s and used in large quantities only since World War II—chlorofluorocarbons. There are no direct health consequences of breathing six times as many chlorine atoms, but the impact on the earth’s environmental system is quite harmful. The hole in the stratospheric ozone layer and the increased irradiation of the earth’s surface by ultraviolet rays is a direct consequence of this new technology.

Similarly, the burning of fossil fuels by five and a half billion people and the destruction of forest land at an unprecedented rate worldwide are now leading to the rapid accumulation of carbon dioxide and other greenhouse gases in the Earth’s atmosphere. The resulting global-climate change is leading to increasing temperatures, threatening to disrupt the climate balance that has remained relatively stable for thousands of years. It is also causing the rise of sea level at six millimeters per year, the retreat of nearly every mountain glacier in the world, the rapid

disintegration of some important ice shelves in Antarctica, and the disruption of important ecosystems upon which much of the diversity of life on Earth depends.

A third potentially destabilizing set of new technologies is what is commonly called genetic engineering. One graduating MIT senior wrote me in e-mail that recombinant DNA technology represents “a powerful tool for countless therapies. However, it could also be very harmful in the wrong hands.”

Balance Needed

In all these examples, there is a clear sense that what is needed and what is at risk is *balance*. The new capacities conferred by discoveries in science and technology clearly have a potential for good and beneficial effects, but simultaneously provoke widespread and deep concern that the use of these new powers can be disruptive and harmful. Another graduating senior in your class expressed



his concerns in these words: "I believe that technology in any form is a new power that can potentially disrupt society. With the current pace of advances, our society is undergoing a destabilizing revolution constantly. Maintaining the delicate balance that we have achieved between individual liberty and societal needs requires diligence and a watchful eye. Failure to do this will lead to either chaos (*Lord of the Flies*), or tyranny (1984)."

How can we create a richer and more productive dialogue about these possibilities that is accessible to men and women who inhabit both of "the two cultures"?

Let me suggest a second metaphor that is based on a new discovery in science, one which I believe has explanatory power directly relevant to the society's need for a discussion of this problem. "Complexity theory" is a new science useful for describing what are called nonlinear systems that exist "at the edge of chaos." By that definition, our society

certainly qualifies as a complex system.

Here is how the author Mitchell WalDROP describes the phenomenon: "Complex systems have somehow acquired the ability to bring order and chaos into a special kind of balance. This balance point—the edge of chaos—is where the components never quite lock into place, and yet never dissolve into turbulence either. The edge of chaos is where life has enough stability to sustain itself and enough creativity to deserve the name of life.

"The edge of chaos is where centuries of slavery and segregation suddenly give way to the civil rights movement of the 1950s and 1960s; where 70 years of Soviet communism suddenly give way to political turmoil and ferment. The edge of chaos is the constantly shifting battle zone between stagnation and anarchy, the one place where a complex system can be spontaneous, adaptive and alive."

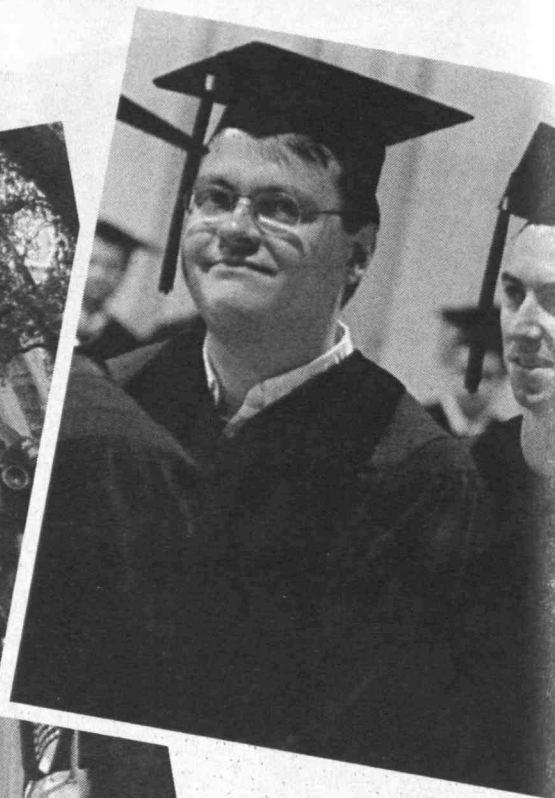
There are a number of societies in our modern world that appear to be in a

state of equilibrium and balance, but move suddenly toward chaos or totalitarian stagnation. Consider, for example, Somalia. The clans that organized traditional Somali society often engaged in confrontation at the boundaries of their respective territories, in clashes consisting largely of symbolic conflict with few casualties.

The introduction of automatic weapons in large numbers and then the mounting of machine guns on light pickup trucks—a combination that became known as "technicals"—tragically transformed the consequences of these once-symbolic conflicts, and the entire system slipped out of equilibrium and into utter chaos.

To take a second example, Sarajevo: the stadium that was the centerpiece of the world's celebration of peaceful competition at the 1984 Winter Olympics became a cemetery a few short years later when that society slipped into chaos.

In the 1930s, of course, fragile



democracies in Germany and Italy moved not toward anarchy and chaos but toward totalitarianism, with horrific consequences for much of the world.

The challenge for modern societies, including our own, is to avoid either extreme—chaos or stagnation—by maintaining the essential balance between stability and creativity. And part of the challenge is how to integrate the changes that flow out of new technologies and new scientific knowledge, how to integrate the new powers and enhanced capabilities, and use them as a source of energy for adaptive change that benefits society as a whole.

There is a model for understanding how such change occurs that I have found helpful. Nineteen years ago, as a freshman congressman, I met a scientist named Ilya Prigogine who had just won the Nobel Prize for chemistry for describing how systems can adapt to sudden and dramatic change. He described the characteristics of what are

called “open systems”—meaning systems where energy or matter, or both, can flow in and out. When the flow of energy in such a system suddenly and dramatically increases, the system responds in a two-step process: first, it breaks down; second, it reorganizes at a higher degree of complexity.

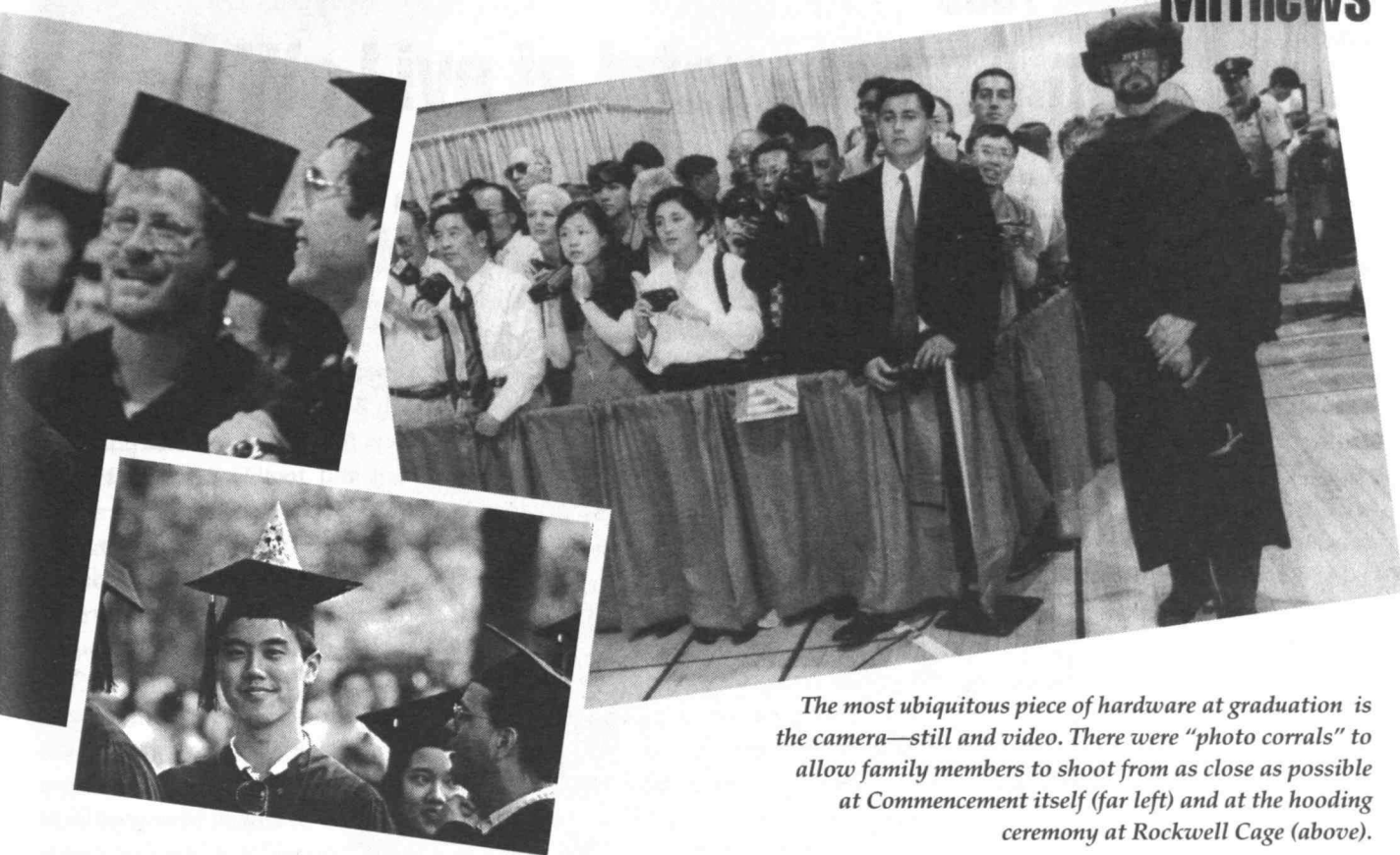
Societies can behave the same way, when there is a sudden and dramatic increase in the flow of energy through the society—automobiles in place of horses and buggies, massive waves of immigration, new trading relationships with new flows of products, surges of new information with the introduction of technologies like television or the Internet. First, long-stable patterns break down, then new ones emerge at a higher degree of complexity.

Integrating Change

Societies are vulnerable to misinterpreting the first stage as a descent into chaos and then overreacting with the imposi-

tion of a rigid, stagnating order. Gerald Holton wrote, “History has shown repeatedly that a disaffection with science and its view of the world can turn into far more sinister movements.” So while we are right to raise questions about the challenges to our society posed by new technologies—as many of you did in your e-mails to me—we must strongly reject the neo-Luddite voices in our society seen in their most extreme and repugnant form in the writings and actions of the Unabomber.

By contrast, the conditions that maximize a society’s ability to integrate rapid change in a healthy pattern include: the free flow of information; strong intermediate institutions such as families, schools, places of worship, civic associations, and communities; and the avoidance of gross inequities. As one graduating senior put it, “I fear that technological advances, if done in the wrong way, will cut off the poor or anyone who doesn’t have access to these changes.” If individuals within a society



The most ubiquitous piece of hardware at graduation is the camera—still and video. There were “photo corrals” to allow family members to shoot from as close as possible at Commencement itself (far left) and at the hooding ceremony at Rockwell Cage (above).

are left behind when others gain new powers and capacities, they can lose their attachment to the society, begin to feel powerless, and then define their relationship to the whole in terms of anger and alienation.

For four years President Clinton and I have been working to ensure that as we enter this new age, our nation addresses the challenge of maintaining a free flow of information—avoiding gross inequities in the access to such knowledge and sustaining the private institutions that promote dissemination of this learning.

Just last week, the president announced a new plan to put two years of college within the grasp of all Americans— young and old—with a refundable tax credit that would make tuition free at most community colleges. We have also proposed new tax deductions for educational costs, lessened the cost of student loans, and promoted an ambitious plan to have every classroom and library in the country connected to the informa-

tion superhighway by the year 2000.

New information technologies have a special power to engender dramatic change in society. The invention of print technology in the 15th century distributed large quantities of civic information, thereby creating the conditions that made possible the nation-state and eventually representative democracy. In our day, the new technologies of radio and television broadcasting have dramatically increased the flow of information everywhere in the world. In Tiananmen Square, fax machines and CNN were seen by Chinese authorities as deadly threats to civic order. The Ayatollah Khomeini spread his revolution inside Iran with audio cassette tapes and telephone lines. The Internet will soon distribute a million times the information now accessible in print to billions of people on every continent.

As another member of the graduating class says, “Each of us may speak with equal voice and be easily heard by any who choose to listen. The powerful or

rich no longer have the monopoly on mass communications.”

Along with the Internet, the most important new tool we now have to extend our ability to create new personal paradigms of understanding is the computer. Computers can magnify our ability to cope with the information explosion in important ways. They can sift through vast quantities of data, searching for the needles in the haystacks that are directly relevant to the questions of interest to us. They can form these data into patterns that are far more accessible to our brains than endless bits of information strung together sequentially. They can artificially alter the scale and speed of the world to make images too large or too small for our comprehension just the right size for us to understand. Processes that are extremely slow can be speeded up for our inspection, and processes that occur naturally at the blink of an eye can be slowed down for convenient analysis. And finally, the largest and

Commencement 1996

continued

most powerful of these machines have led to the emergence of a completely new form of knowledge creation. In addition to inductive reasoning and deductive reasoning, we now have a new variety that blends aspects of the first two. "Computational science" can create artificial realities within which experiments can be conducted.

How will society adapt to the dramatic changes that accompany this new revolution? The reemergence in our world of rigid, stultifying, fundamentalist ideologies can be seen as one extreme in reaction to the vast increase in data now washing through world civilization.

At the opposite extreme, the fear of chaos was expressed by another MIT graduate on the Athena system: "Free speech uncontrolled can break down our social norms and common beliefs, allowing extreme opinions to find and strengthen each other or allowing unsubstantiated, unfounded 'truths' to be disseminated without challenge or resistance." Hers is a concern I partly share. For example, I believe we have an obligation to assist parents who want to exercise responsibility for protecting young children from materials which they as parents believe their children are not ready for.

But let me also state my clear and unequivocal view that a fear of chaos cannot justify unwarranted censorship of free speech, whether that speech occurs in newspapers, on the broadcast airwaves—or over the Internet. Our best reaction to the speech we loathe is to speak out, to reject, to respond, even with emotion and fervor. But to censor—no. That has not been our way for 200 years, and it must not become our way now.

Managing Information

The great historian of science, Thomas Kuhn, described the way in which our understanding of the world properly evolves when faced with a sudden increase in the amount of information. More precisely, he showed how well-established theories collapse under the weight of new facts and observations that cannot be explained and then accumulate to the point where the once-useful theory is clearly obsolete. As new facts continue to accumulate, a threshold is reached at which a new pattern is suddenly perceptible and a new theory explaining this pattern emerges. It is an important process not only at the societal level but for each of us as individuals, as we try to make sense of the growing mountain of information at our disposal.

The breakthroughs in understanding that we need in order to adapt to change, while they may be facilitated by the new capabilities computers and the Internet make possible, will not be caused by computers and they will not take place inside them. They will only take place *in our lives*. They will only have meaning in relation to human values.

How many of you have ever tried to see the hidden three dimensional image in modern computer-generated pictures called, according to one brand name, the "Magic Eye"? For those of you who have not seen these novelty pictures, they consist of complex patterns that seem like busy, partly incoherent designs that are intended to be viewed in a special way. My children taught me the technique. You hold them close to your eye and focus on a distant point beyond and through the plane of the image. Then you wait patiently until your brain has processed the information in the image,

which then reveals a three-dimensional picture that comes into sharper focus when you slowly move away from the image. The most important breakthroughs and advances in understanding can only come when we take the time to look beyond the surface of the problems we face and focus on what is most important in our lives.

The same is true for you today. The noise level in our civilization is rising. The flood of information on every subject makes the task of understanding change more difficult than ever. The temptation to rely on new technologies as a substitute for reflective thought is a dangerous trap. If you are seeking a deeper understanding of what your life is all about, you will not find that meaning on the surface of your life. You must look beyond and through your life, and focus on a distant point and be patient.

Nor can you understand your life in isolation from its context: your family, your community, your nation, your world, and the fabric of existence of which you are a part. If you seek healing in your life, it is to be found in these relationships. If you seek spiritual meaning in your life, you will not find it by thinking of what you want to do next, but rather by reflecting on your whole life in its largest context.

If you are pursuing happiness, it will not be found in a set of nostrums, nor in the undisciplined pursuit of pleasures. It is more likely to be found by living your life with enough stability to faithfully discharge your responsibilities in relation to others, but also with enough spontaneity to adapt continually to the new challenges you will encounter and to seize the new opportunities inherent in a creative and balanced life.

That is what I wish for you. God bless you and good luck. □

We Live in Interesting Times

This is my last column as president of the Alumni/ae Association. My musings on the state of higher education will henceforth be channeled into the columns of the *New York Times*, where higher education is my new beat.

I can't imagine a more interesting topic. In this high-tech information age, a college education has become a virtual necessity for anyone seeking an interesting job that offers a good living. For growing numbers of individuals, graduate school is becoming necessary as well.

But except for the fact that higher education is more essential than ever, little about it seems certain. Everything is being questioned: from what it should consist of (liberal arts or career training), to how it should be delivered (face-to-face or using high-tech formats such as the Internet), to how it should be paid for (public or private financing).

This is an opportune time for MIT to be reviewing the educational experience and campus life of its undergraduates through two new commissions. In its alumni/ae, as well as in its students and faculty, the Institute has a pool of experts to help appraise what it offers.

When I began the year as president, I wrote about the abundance of remarkable people and events within the Institute—what I called the “richness” that is MIT. During the year, as I visited with many of you around the country and as I conversed with others over the Internet,



Karen Arenson, '70, as the 1995-96 president of the Alumni/ae Association, led the Commencement procession.

I was reminded of the richness that also lies in MIT's community outside of Cambridge.

Some of my contacts were with people I knew when I was at MIT but haven't talked to in 25 years. Others I had never met before. One lives a few blocks from me in New York. Others were as far away as Greece or Pakistan. I had the chance to talk to graduates who are concerned about the world around them, who are concerned about the lack of national leadership, about the role of science, about higher education, and, of course, about MIT.

Some of the alumni/ae I talked to are using technology in innovative ways to express their concerns. In one project I

found particularly intriguing, an alum had established a site on the World Wide Web to enhance economic development for a small town in western New York.

And the MIT skills extend down: As a community service project, the son of two MIT graduates set up a Web page for his temple and is helping to educate the temple membership on how it could be used.

We are making progress on developing our own electronic community, too. A committee on online services, appointed by the Association Board of Directors and headed by Bob Johnson, '63, has

laid out a roadmap for where we should go beyond our Alumni/ae Association Web page. Our first project will be to create an “e-mail address for life” system, beginning with the Class of '96. If that works, we will extend it to everyone. You will hear more about this and other initiatives in coming months.

What I look forward to most is some chat lines or bulletin boards that will allow alumni/ae to converse. I've participated in one non-MIT listserve made up mainly of professors who teach about nonprofit groups and philanthropy. The conversation ranges from the mundane to the fascinating, and I sign on regularly to see who is saying what. I can easily envision such conversations among MIT alums when we set up an open exchange system.

Even as we press ahead electronically, however, we should not lose sight of the

Association President

continued

real world and the value of face-to-face contact. Talking over the Internet is a start, not a finish. One of the most interesting suggestions I received this year was a proposal that we try to hold a reunion of several adjacent classes, rather than just one year at a time, since so many of us had friendships that spanned the classes.

I recently had the opportunity to attend a multi-year reunion celebrating the 25th anniversary of the graduate program I attended (not at MIT). Several hundred people convened at cocktail parties and lunches and dinners. People tended to gravitate to friends they knew from their classes. But there were also a smaller dinner at a profes-

sor's home and a seminar limited to the first five classes in the program. For me, those two sessions were especially interesting because they were small, they involved people in years close to my own, and I was able to chat with many individuals, including people I had known casually and some whom I had never met as a student.

That experience and my almost 30 years participating in the MIT community make me think that multi-year reunions are an idea worth trying—if we can come up with an appropriate model. I would certainly sign up, since there are many people from the late 1960s and early 1970s whom I would love to see.

In the meantime, I will be happy to

carry on conversations electronically, even though I stepped down as president on July 1. Although there are many people I did not get to meet this year, I trust there will be opportunities to do so in the years to come. I leave the Association in the hands of a very capable successor, DuWayne Peterson, '55. I hope he has as much fun as I did. □

Karen Arenson

KAREN WATTEL ARENSEN, '70
Immediate Past-President, Association of Alumni and Alumnae of MIT; 125 W. 76th St., Apt. 2A, NY, NY 10023; e-mail: <dhbm13d.prodigy.com>

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ClassNotes

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We regret to report the death of **Timothy Shea** of New Jersey, on June 19, 1995. Timothy was a longtime senior engineer at AT&T who helped improve motion-picture sound and develop anti-submarine electronics during WWII. He also was president of AT&T's Teletype Corp. subsidiary and VP and general manager of Sandia Corp. Survivors include three sons (Robert, Timothy Jr., and John), a daughter (Patricia), and his wife, Norma Marie Zinn Shea.

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75th Reunion

Robert F. Cummings writes from Greensboro, N.C.: "I have been retired for a number of years now. After a long career in engineering work, the last 31 years have been in consulting engineering. My wife passed away in 1992. I am now in a retirement home, but quite active. I am 96 years old."

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Only once since we were graduated have the numbers of the class increased. That was when we made several women honorary members of the class several years ago. Well, it has happened again. Since the last issue of the *Review*, Mrs. **Kay Stratton** has been voted an honorary member of the Great Class of 1923. Kay is the widow of **Jay Stratton** who we all

remember so well.

Only one death to report. **Howard G. Doster** passed away September 17, 1995. He had an eventful life. He sailed among the islands of the Caribbean, visited the islands of the South Pacific and spent a month in New Guinea, where he traveled 100 miles up the Sepik River from Ambunti, the last civilized outpost on the river, to the tribal native villages that still live under the conditions and customs of the Stone Age.—**Royal Sterling**, secretary, Apt. D201, 2350 Indian Creek Blvd. W., Vero Beach, FL 32966-5103; tel: (407) 562-3937

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Please send news for this column to: Co-secretaries: Colonel **I Henry Stern**, 2840 S. Ocean, #514, Palm Beach, FL 33480; **Katty Hereford**, 237 Hacienda Carmel, Carmel, CA 93923

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It is with sadness that the passing of three classmates must be reported. **Walter J. Rhodes, Jr.**, died January 29, in Lewisburg, Pa. Following graduation he worked for

Rust Craft Publishers in Boston. In 1929 he moved to New York and joined Metropolitan Life Insurance Co. in the company's Group Insurance Policyholders Service Bureau. Practically all of his 39 years with Met Life were spent in areas requiring analysis, research, and planning. He retired in 1968 as staff VP, Field Management Division. Walter then moved to New London, N.H. There he became active in the First Baptist Church and the Tracy Memorial Library. He served as the church clerk for 12 years and as library trustee for five and a half years. His avocation was writing and he had several articles published. In 1992 he moved to Lewisburg to be near his family. He is survived by his son, two granddaughters, and four great-grandchildren.

Thomas Nelson died in Clearwater, Fla., on January 20. He was the retired president of American Twine and Fabric Corp., in Boston. A Baptist, he was instrumental in combining the three churches at Coolidge Corner in Brookline, Mass., to form the United Parish. As a mason, he was past district deputy grand master of the Fourth South Boston Masonic District and the past master of Loyalty Lodge, Jamaica Plain. He is survived by his son.

Maurice Byard Frost died in Riverton, N.J., on July 7, 1995. He worked at the American Water Works in Philadelphia for 38 years and was also a licensed professional land surveyor. He was the warden, vestryman, and treasurer of Christ Episcopal Church in Riverton from 1954 until 1972. He leaves two sons and three grandchildren.

When reporting the death of **Frank Warburton**, information regarding his military record was not available. It has now been received and is well worth reporting. Frank was a veteran of WWII, serving with the Army Air Corps from 1940 to 1947, rising to the rank of colonel. He was then a colonel in the Air Force Reserve until 1961. While in the Army, he set standards for temperature tolerances to weather. In 1946, he was sent to Germany to dismantle German wind tunnels for the Army.

There is some good news to report. **Court Worthington** and I were recently informed that four MIT students had received scholarships from the Class of 1925 Scholarship Fund. We had no knowledge of such a fund. **Audrey Saraco** of the Alumni/ae Association did some research and reported that the fund was established in 1975 and each year since that date the income from the fund has been used to provide scholarships to MIT students. Why the class officers have never heard of this surprising activity remains a mystery. However, there is a Class of 1925 Scholarship Fund and when you make your donation to the Alumni/ae Fund you might consider earmarking it for the 1925 Fund.—**F. Leroy (Doc) Foster**, secretary, 434 Old Comers Rd., Chatham, MA 02633

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We regret to report the deaths of the following classmates: **James F. Carey**, of Wallingford, Pa., June 11, 1995; **George W. Bates**, of Durham, N.H., November 29, 1995;

Milton B. Morgan, of Newtown, Pa., January 1, 1996; and **Albert F. Kinzey** of Stockton, Calif., October 2, 1995.

James Carey was a captain in the Army Reserve when WWII broke out. He served in the European-African-Middle Eastern campaigns and received the Purple Heart and four battle stars. By the end of the war, he attained the rank of lieutenant colonel. He later retired from the Army Reserve. He is survived by his wife, the former Ann LaBrum, and 61 nieces and nephews.

We have no additional information on the other classmates at this time. Please send news for this column to: Class Notes Editor, *Technology Review*, W59-200, 77 Mass. Ave., Cambridge, MA 02139

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70th Reunion

Please send news for this column to: **Joseph C. Burley**, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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Our class news frequently involves deaths of our classmates as well as their activities and accomplishments from official or unofficial sources, and it is sometimes difficult to

be prompt, complete, or accurate; which may lead to embarrassment or confusion. As secretary, I would like to be able to report any information that would be appreciated by the reader and of comfort to the families. The MIT Alumni/ae Association Office includes whatever is available in their class secretaries due date notification for each issue of the *Review*.

In this issue there are two deaths previously mentioned in notes but more details have been received. **Elisha Gray** died February 27, 1996, in Benton Harbor, Mich. Bud had a notable career in both the business world and in society, including all the top offices in the Whirlpool Corp., General Food Corp., and A.O. Smith & Co. He was active in the economic development of the Benton Harbor Michigan area and was on governing boards of the American Red Cross and the MIT Corporation. He was also a hospital trustee and received several honorary degrees from universities.

Roland Deming Earle died on April 16, 1995, in Plantation, Fla. Roland was an amazingly talented and prolific chemical engineer and inventor though he did much of his fundamental research in the kitchen of his home and referred to himself as a "Dixie Cup" chemist. He was instrumental in the development of synthetic rubbers, important in WWII, held many patents in the chemical and food preservation fields, and founded his own chemical company.

We are proud of the renown these classmates brought to our Institute, and we congratulate their families. Our 70th Reunion in 1998 is close upon us. Let us all be there, in spirit if not in fact.—**Ernest H. Knight**, secretary and president, 168 Ai Plummer Rd., Raymond, ME 04071

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Three classmates have passed on since our previous Notes: **Adrian N. Clark**, of Woodbury, Conn., December 2, 1995; **Maxwell Parshall**, of Hamilton, Mont., January 30,

1996; and **Eugene C. Koo**, of Philadelphia, Pa., in 1968.

Eugene Koo went back to China, taught at several Universities and served as director of the National Bureau of Industrial Research, Ministry of Economic Affairs. His scientific papers were recently published by Hwa Tung University of Science and Technology, Shanghai. . . . We have no further details about Adrian Clark and Max Parshall.

In July we reported that **E. Neal Wells** died December 25, 1995. We thank his sister, Virginia Hatton, for sending additional information. At MIT, alma mater of his father and also an uncle, Wells was a member of SAE fraternity and varsity crew. Following graduation, he worked for Bell Telephone Co. of Pennsylvania until called to active duty in the Army. Captain Wells was stationed at the Pentagon as deputy chief of the Signal Planning Board. He later joined AT&T in New York and retired in 1970 as toll planning engineer. In this capacity he was involved in internation-

al studies that took him to Canada, Switzerland, Italy, Argentina, and Mexico. Two of his hobbies were photography and railroads. One of his sister's earliest memories of her brother, "when he couldn't have been more than 10 years old," was that he put electric lights in her doll house using dry cell batteries. Besides his sister, he is survived by his wife, Helen; a daughter-in-law; two grandchildren; several nieces and nephews; and a cousin.

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At rare intervals, the *Review's* deadline for submission of Class Notes occurs while we are traveling overseas. On such occasions my Notes have been prepared at exotic loca-

tions—the January 1986 Notes in Tanzania and the August 1987 Notes on the M.S. *Xi Ling* on the Yangtze River. This month's Notes are being completed on the Holland America's *Maasdam* on a western Mediterranean cruise that Louise and I are enjoying. As earlier forecast, we embarked at Lisbon, will visit a total of seven ports, and then fly home from Rome. Originally the Yicka Herbergs planned to be with us on this cruise, but shortly before departure Yicka developed a health problem that forced them to cancel.

Cruising on the *Maasdam* is an impressive experience. A largely Indonesian crew of 600 provides floating luxury for 1,260 passengers with efficiency and good humor. At our first dinner afloat the long arm of coincidence reached out and touched us: one of our tablemates was Norman Moysa of Vancouver, B.C., a former student at the University of British Columbia of **Joe Kania**. We recently received a note from Joe reporting that although he and his wife, Florence, have slowed down, they are still in reasonably good health.

As of mid-March Carol and Dick Wilson had returned from a Caribbean cruise—St. Martin to Grenada. Dick further disclosed that he has a new set of golf clubs with graphite shafts that he looks forward to trying out when the weather permits. In the meantime, cross-country skiing has kept him in shape. Also he has a new computer that he is trying to master. . . . From Wellesley Hills, Mass., **Bill Harris** reports that at ages 96 and 93 he and his wife are doing "quite well." He now uses a walker but still drives for short distances for shopping and dinners out "two or three times a week." . . . **Al Bird** still is quite active in municipal affairs in Rockport, Maine, where he lives. Several years ago he promoted and chaired a \$6 million sewer project that was successfully completed in 1993. Currently he is the Rockport representative on a seven-town water-supply study and advisory board seeking to increase the area water supply. For recreation he sails a small day sailer with his wife, Grace.

Within the past month we have received word of the deaths of three more of our classmates: **Ralph Swingle** on January 3, 1995; **Sven Lindhard** on December 18, 1995; and **Morell (Hijo) Marean** on February 16. Ralph retired in 1971 as associate general patent counsel of Westinghouse Electric Corp. after 40 years of service. Upon retirement he and his wife, Dorothy, moved to Ft. Lauderdale,

Fla., where he was living at the time of his death. Since the notice I received does not mention his wife, I assume that she predeceased him.

Sven worked for many years as a special process engineer in the New York office of F.L. Schmidt and Co., designers of cement plants and manufacturers of rotary kilns and grinding mills. He retired in 1969 as the result of a stroke. In later years he moved to New Bern, N.C., where he was living at the time of his death. He and his wife, Lila, who survives him, were married for 66 years.

For many years Hijo Marean and his wife, Eleanor, had a real estate and insurance business in Marblehead, Mass. In 1973 they sold their business and retired to Delray Beach, Fla., where they bought a condo and enjoyed the amenities of Florida living for a number of years. In the late '70s Eleanor developed health problems and she died in the spring of 1982. After her death, Hijo moved to Dallas to be near his daughter Carol. There he began teaching mathematics to gifted elementary school youngsters and was so successful that his classes were the subject of a feature article in one of the Dallas newspapers. However he did not like Dallas and moved back to Florida, where he was living at the time of his death. He is survived by two daughters, a son, and eight grandchildren.

Hijo was the first of our four class secretaries, although he didn't hold the job very long. He was succeeded by Parker Starratt who served until the mid-1950s. Our third secretary, George Wadsworth, served only a few years and then turned the job over to me in 1960.—Gordon K. Lister, secretary, Apt.40, 5707 Williamsburg Landing Dr., Williamsburg, VA 23185

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We've heard from Harry Wagner, who says, "At age 90, I have taken time off for recuperation!"... John Parker celebrated his 87th birthday and the 50th anniversary of the founding of the Department of City and Regional Planning, University of North Carolina at Chapel Hill, all during the same week in March of this year. He writes, "My wife and two sons have died, but I am blessed with two daughters-in-law and four grandchildren. . . . Best wishes to the class on it's 65th."

Unfortunately, we have several deaths to report. Albert Coleman, of Daytona Beach, Fla., died March 4, 1996. During WWII, Albert was an instructor for the MIT Radar School for military officers and was a technical advisor for the Institute of Medical Research in Camden. Survivors include his wife, Alice; three sons; a daughter; his father, Albert M.; eight grandchildren, and eight great-grandchildren. . . . George Moy died September 12, 1995. After graduating from MIT, he traveled to China where he worked as an electrical engineer. During WWII, he was instrumental in saving his family and bringing them to the U.S. He worked for Burns and Roe in New Jersey for 44 years designing power plants. He is survived by his wife, Bertha Elaine; a son, George Jr.; a daughter-in-law; a sister and brother-in-law; and many nieces, nephews, grandnieces, and grand-nephews.

Donald A. Holden, of Charlottesville, Va.,

died November 12, 1995. After retiring from Newport News Shipbuilding and Drydock Co., Donald helped found the Council of Independent Colleges in Virginia and served as its executive director until 1983. He began with shipbuilding as a draftsman in November 1934 and rose through the ranks to become executive VP. He was later named president and finally chairman. He is survived by his wife, Eleanor Watson Holden, and a son, H. Warren Holden, of Springfield, Ohio. . . . Kenneth E. Wischmeyer, of Saint Louis, Mo., died January 16, 1996. We have no more information on Kenneth at this time.

Please send news for this column to: Class Notes Editor, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

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65th Reunion

I heard that Arthur Marshall was back in the hospital in Springfield. I called and found out that there was a deterioration in his spine and he was undergoing tests. His spirit was good and he hopes to attend our reunion with or without a wheelchair. It was interesting to learn of his longtime commitment (since 1938) to the Boy and Girl Scouts of his area. His children and grandchildren were scouts and he still serves on the council. Recently, he and his family established a memorial scholarship fund for those scouts who wanted to go to school or summer camps. The memorial was for his son, David, who died from a massive heart attack at the age of 58 in 1993.

It is my sad duty to inform you of the deaths of some of our classmates with whatever obituaries I have. Mrs. Carl Wahlstrom writes, "It is with deepest sorrow I must convey to you the death of Carl, my husband of 57 years. He suffered a stroke nearly two years ago. His health steadily declined the last two years of his life."

Mrs. Charles Spiegel writes, "I'm sorry to inform you that my husband, Charles Spiegel, died on January 13 after a short bout with cancer. Charles was active in the MIT Club of Southern California, a member of the Educational Council, and he helped edit physics textbooks. In addition to me (his wife, Doris, of 56 years), he leaves four children, seven grandchildren, seven great-grandchildren, and many friends. We miss him terribly!"

Frank S. Chaplin died February 2, at his home in Doylestown, Pa. He worked for 10 years as technical engineer for Budd Co., where he was responsible for designing railway trains and a stainless steel airplane. Since 1945, he was associated with Franklin Institute in various research capacities. In the 1950s, he worked on the Army's self-propelled atomic cannon, known as "Big Bertha." For several years he was a consultant. He retired in 1980. He is survived by his wife of 54 years, two sons, two daughters, and four grandchildren.

We also learn that Willard H. Foster died on January 9, and that Adolph I. Warsher died on March 25. When we receive more obituary information, we will pass it on.

Russell Robinson colorfully accepts and starts his new duties as class agent. Let me quote him directly: "Behold! I am your new class agent! I'm not sure what vast powers this

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windfall confers on me, but 60-odd years ago at Tech I was some sort of agent. My chief function then was to follow the gyrations of Ann Corio and her voluptuous team: then, when they were sufficiently outrageous, to buy tickets to the Old Howard, for the learned edification of my upperclassmen. Remember?"

In another month some of our classmates will be attending Tech Day 1996. John Brown, our president, is preparing a meeting for us to discuss plans for our 65th Reunion (next year). See you then. Write!—Melvin Castleman, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907-1643; tel: (508) 531-0053

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In a very moving personal tribute in memory of George A. Stoll whose passing on October 18, 1986, was recorded in the Feb/March 1996 *Technology Review*, a

Theta Chi fraternity member H. Arthur Zimmerman, '37, of Port Washington, Wisc., extols George as "the fine gentleman that he was." A true leader and principal purveyor of food for the fraternity, George is also remembered for organizing a dance band that played as well for other fraternities at formal affairs. (Note: George Stoll is seen in the 25th Reunion Classbook just to the right of Clarence Farr who is playing piano.) George's family business thrived on the same business acumen and enthusiasm he displayed at MIT, and Art Zimmerman wanted us to know more about a little-known classmate. Less was never more in my book.

A very disconcerting letter from Richard "Dick" Fossett's wife Charalee informs us that Dick is undergoing treatment for the late stages of Alzheimer's at a private facility near their home. Charalee was more than pleased when Dick asked her to dance on hearing an impromptu playing of a piano at the facility. Writing to Dick Fossett, c/o Charalee Fossett, 80 Joy Way, Portola, CA 96122 would be a wonderful way of thanking them both for their years of service to our class.

Since Friday, June 7, was to be an open date for many at the 63rd Reunion, I thought to ask Dr. Edward R. Atkinson whether the Red Sox might be playing a home game that day. This amounts to heresy on my part, since I became (perhaps a charter member) a frenzied *Boston Braves* Knothole Gang kid, definitely beginning my love for baseball. Ed replied that the Red Sox would be playing a night game on that date, but that evening coincides with the Cardinal and Gray Dinner/Sing-Along, which I wouldn't miss for the world. I think Dr. Ed has the voice to be there as well, since he has been rehearsing with a 250-voice chorus and the Boston Festival Orchestra for a performance of Beethoven's *Missa Solemnis* at Symphony Hall. Ed had been making five trips to Boston from his Amherst home in eight days. Thereafter he plans to visit his daughter at Cape Canaveral and finally return to the University of Massachusetts for the dedication of a new polymer research laboratory. While at

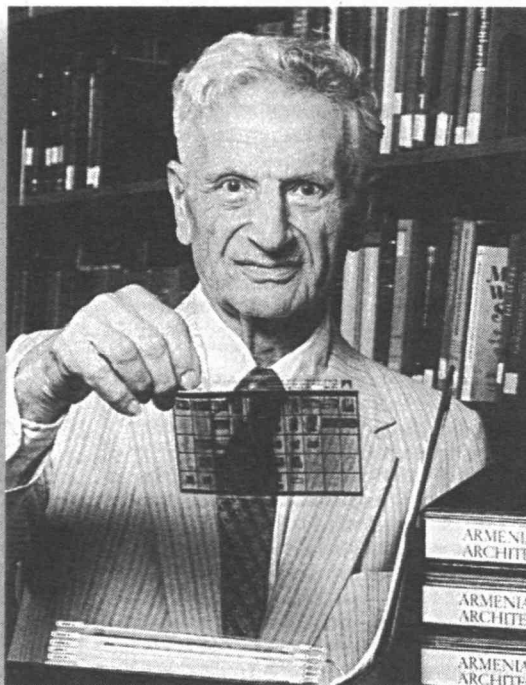
UMass, he will observe the awarding of an honorary doctorate to one of his close friends, Dartmouth Professor Emeritus Walter H. Stockmayer, MIT class of '35 (V).

William A. Gray's wife Nancy apprised our Wilber Huston of her husband's death on March 16, sending along a too brief obituary from the Charlottesville, Va., newspaper. Bill Gray came to MIT from Boston's English H.S., along with a fairly large contingent from that same school. At MIT, he earned his SB and SM in Course VI, EE. His first job with Hygrade-Sylvania lasted from 1934 to 1938, when he and fellow classmate Edward S. Goodridge formed Induction Heating Corp. Selling off their renamed Hathaway Instrument Co. to the notorious Roy Cohn, they finally won their lawsuit to collect payment from his in 1968. During World War II, Bill Gray was an intelligence officer with the CIA serving as a lieutenant colonel, in the Radio and Radar Division of the War Production Board. In retirement, he became heavily involved in the boxwood nursery industry in Fairfax County, Va., later serving as research director of the American Boxwood Society. Among his survivors are his wife, two stepsons, Harrison and Douglas Butturff, and their children. The obituary in the Charlottesville *Times*, clearly indicates the humanity of this man when it closes by noting that "Mr. Gray willed his body to medical science."

When she received a form letter in 1993 requesting biographical information for our 60th Reunion Classbook, the wife of Frank Joseph Bleil did not respond, since her husband's health was declining both physically and mentally at the time. As difficult as it was to bear up under those adverse circumstances, Mrs. Bleil finally answered apologetically that her husband had passed on as of Dec. 28, 1995. Frank J. Bleil graduated MIT with an SB, Course VI, EE, having come from Paterson Central H.S. in New Jersey. Immediately after graduation, he began with Hygrade-Sylvania in 1934, followed by various duties at Wired Radio and Daven Companies. He closed his engineering career as engineer-in-charge for the Columbia Broadcasting System in New York City. During WWII, he served as an officer with Radio Operations in the Office of War Information. As one might guess, Frank was a ham radio operator, having a station with the call letters W2AXQ. He was also interested in public education, serving on Boards of Education in the towns where he lived. Of his survivors, we know only of his wife, Irene, and a daughter, their only child.

Of George Richards Churchill, Course XV, management, we have very little information and no obituary notice. His wife Charlotte reports only that George passed on as of November 8, 1995. However, our 60th Reunion Classbook has a somewhat restrained autobiographical account that shows a very dedicated person in his career and with his family. In 1934, he relates the development of

a metal-polishing brush, followed by other products through 1939. In 1945, George introduced a rotary buffing wheel using (in his words) "fingers" of cloth; sales of the buffing wheel grew to one million dollars in 1950. He manufactured and sold his Churchill Finger-Buffs nationwide and eventually sold the business in 1980. In retirement, George and Charlotte, his wife of 57 years, have managed to live as quietly as their three children, eight



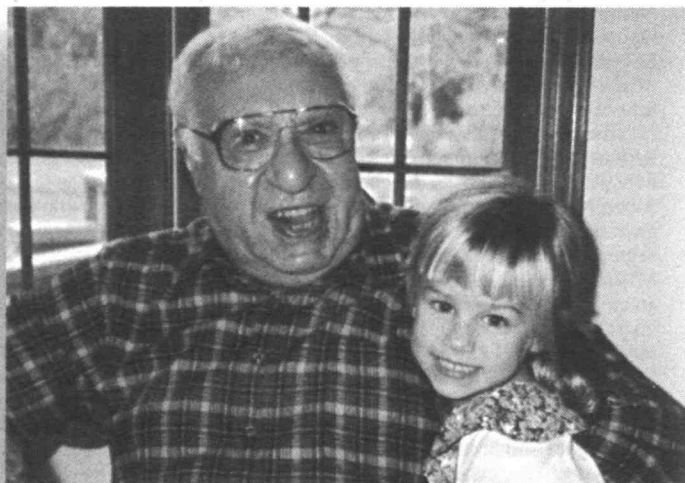
V. Lawrence Parsegian, '33

grandchildren, and one great grandchild would allow in their North Weymouth, Mass., condominium.

Many sources of information relate the passing of Vozcan Lawrence Parsegian as of April 6, 1996. Although the *New York Times* usually has the most definitive obituary notices anywhere, I believe that the Albany, N.Y. *Times-Union*, sent to me by John Langley, tells it better. Born in Van, the ancient capital of Armenia (now part of Turkey), Vozcan and his family emigrated to the U.S. at the time of the Armenian Genocide of 1915. Graduating from Chelsea H.S., he entered the Lowell Institute, from whence he came to MIT to earn an SB in physics, Course VIII. After receiving a doctorate in nuclear physics from New York University, he was installed as professor of nuclear engineering at Rensselaer Polytechnic Institute. In 1957 he became dean of

engineering at Rensselaer, where he inaugurated a program in nuclear science and engineering, built a linear accelerator, and strengthened the faculty and curriculum in graduate research and education. By this time Vozcan had assumed the name Lawrence. Retired in 1975 as professor emeritus, he spent the next 20 years on a seven-volume text, with photographs, on nearly 2,000 years of Armenian church architecture. He was outspoken on atomic energy policies after serving as director of the research division of the Atomic Energy Commission's office in New York in the early 1950's and he was critical of the imposition of secrecy on the work being done in university laboratories. Although he was essentially a man of science, I came to know Lawrence Parsegian in the first formative years of an MIT Armenian Club, where he breathed social life into an otherwise mute student fiefdom. Lawrence Parsegian's underlying resolve was to repay this country for extending asylum to himself and his family in their dire need and at the same time elevate his native country of Armenia to a level of appreciation for its little-known cultural history. I want you to know that V. Lawrence Parsegian's wife, Varsenig, and I have grandfathers who were brothers. Had the Parsegians not driven from their home in Troy, N.Y., to the 60th Reunion, I would not have known that, since Varsenig researched the subject. The survivors are his wife of 58 years, Varsenig, a son, Dr. V. Adrian Parsegian, a daughter, Dr. Elsa V. Parsegian, a sister, Florence Bergey, and three grandchildren. A memorial mass was held in the Armenian Apostolic Church of Watervliet, N.Y.

Finally, I will end on a very happy note. I must rush to complete these notes, which are due on May 10, also the day I fly off to Cortland Manor, N.Y., to be with my lovely daughter Bidu (named for Bidu Sayao) and her soon-to-be husband Jon Kiphart. Daughter Bidu is a producer for shows, including TV. Jon is an electronics engineer whose last job was directing Sony engineers setting up the electronics on the new Celebrity Cruise liner *Century*. I must add that the flower girl for my daughter's wedding will be a charming grandchild of mine, Emily Franciska Tashjian, not yet 6 years old.—Berj Tashjian, secretary, 1245 Briarwood Ln., Northbrook, IL 60062-4556; tel: (847) 272-8683



Berj, '33, and Emily Tashjian

As the winter season comes to an end, and we begin to get ready, reluctantly, to return to New England, we look back at the last few weeks since we typed the last set of Notes and

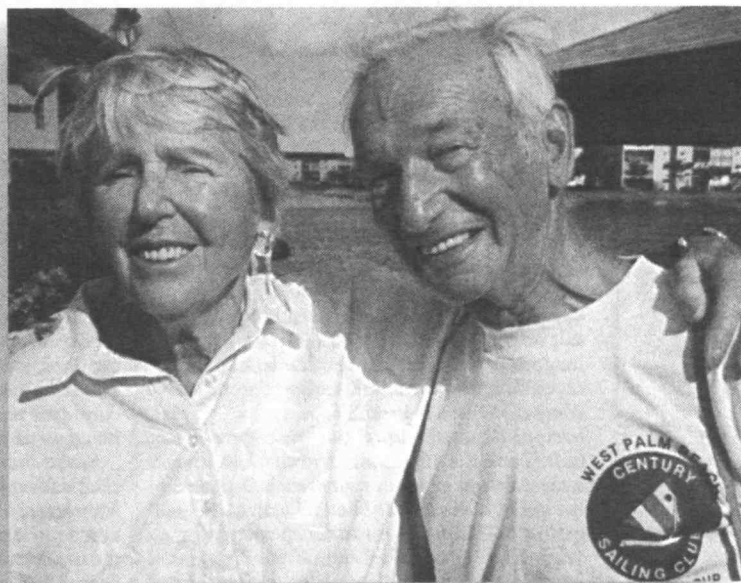
find the following which should be of interest to you, our classmates. First, **Ed Asch** and **Annette** arrived in Coronado. They had rented a house in L.A. to be near their new grandchild and to visit their children. They were filled with enthusiasm over the new addition to their family, and Ed was looking forward to a repeat of his visit to the Hotel del Coronado in the 1950s. Since we live just south of the hotel, we all walked up to make the pilgrimage. We were Ed's guests at a lovely dinner at Loew's on Coronado Bay, and we followed up with breakfast at our apartment.

Jim Eder came with an offer of tickets to witness the dedication of a new battleship on our last day here, which we had to decline, reluctantly. Jim repeated his thanks for the sail we had had recently on my friend's 46-foot Kelly-Peterson. . . . **Jim Eider** reports that **Jim Sweeney** has been suffering with a severe case of depression. We wish him well and hope that he will be fully recovered and back to good-health soon. . . . A note from **Ed Hadley**, '38, looking for an address for **Art Manson's** wife, **Maureen**, who is no longer in the Gonzalez area. Anyone who has her current address is asked to relay it to: **Ed Hadley**, 50 Spofford Rd., Boxford, MA, 01921-1504.

A note and photo of **Oscar Cantor** and wife **Florence** picture them both in ruddy good health. They report three children and six grandchildren. He is keeping very busy as president of his condo association, which involves the upkeep of premises plus aiding many less able residents. He and Florence recently took a snorkeling cruise to a number of Caribbean Islands and the Gulf of Mexico. He races weekly in Sunfish races, which he says, are "somewhat different than the eight-oared shell." Oscar does some reading, plays tennis and exercises regularly, and plays occasional chess. . . . Speaking of eight-oared shells, the spring issue of *Squaring the Blade*, an interesting publication by the Friends of MIT Crew, lists Oscar, **Tom Burton**, **Wally Bird**, **Agness Lucke**, and **Bob Roulston** among the donors who support the "Friends" organization. When **Bob Roulston** sent in his contribution, he told us of a recent move the Roulstons have made to: 4436 Meandering Way #30SAG, Tallahassee, FL 32308. "Still summer at camp in Center Ossipee, N.H., and Elderhostel for traveling. From this new address at Westminster Oaks—a Presbyterian Retirement Community—and still quite active in choir and FSU activities. Bob was always interested in choirs and choruses, and the memory of his recruit-

ing for spear carriers for the Boston opera still lingers. Bob was always looking for classmates 6 feet or taller so that they could be seen in the back row."

Ed Taylor writes from **Eliot, Maine**, where he recently celebrated his 83rd birthday. "I have had many falls on rough streets of SMA. Now need a cataract removed. My wife, **Winifred**, is fine. We have a 53-year-old son. I am busy gardening, giving to charitable and environmental organizations. Stock speculation is one of my hobbies. **Winifred** and I are just back from our usual five months in Mexico. Mostly we stay in some small apartment in **San Miguel Allende, GTO**, and we have many American and Canadian friends there. (Altitude 6,500 feet) I volunteer in the SMA library, usually two hours, six mornings. Repair and check filing of some thousands of paperbacks (English) as they return from circulation. I read regularly and my favorite subjects are historical novels and life in other places, some biography. Favorite author is **Robertson Davies**. I play duplicate bridge regularly in SMA, fairly well, and gentle calisthenics are my regular exercise. I have not seen any classmates since 50th Reunion. Any 34's who remember me would be welcome at our home on their way to or from Maine. We are only six miles off I-95, first exit after high-level bridge. Phone 207-439-3559."



Florence & Oscar Cantor, '34

Walter Kut writes from **Whiting, N.J.**, that both he and his wife are in good health. He keeps busy as a volunteer in several organizations in their retirement village, helping seniors in their area. He reads constantly, trying to keep up with advances in science and technology. "I hope other classmates feel as I do about their association with MIT. The start in engineering and in an academic career received at MIT has proven most satisfying to me."

About ten classmates, five spouses, and one widow were on hand April 23 for an informal meeting of the expanded reunion committee. Most of the conversation at lunch centered around the brutal winter that New England

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experienced this past year, and the meeting yielded lots of news for this column. . . . First, those who sent regrets: **Paul Wing** and **Clare** had to drop out because they were not feeling up to snuff. Clare needed a cataract operation and had a few problems, but they are all okay now. Paul is in the final stages of his soon-to-be-published book, *3-D Viewers before 1930*, and has also surrounded himself with a Macintosh computer, printer, scanner, etcetera, and is trying find time to master them all. . . . **Tom Burton** and **Barbara** also missed the meeting for medical reasons. Tom had surgery to remove a growth on his left hand, and a skin graft was necessary. The news from the visit to his doctor was good. . . . And **Roger Coffey** was unable to attend because he is acting as his own general contractor in a garage he is building.

Al D'Arcey reports that he is feeling fine, does some reading, plays a lot of pool and golf, and gets regular exercise. Al has always been an avid golfer and always handled the golfing arrangements at our reunions. . . .

George Gahm reports that he will head out to Oregon and the West Coast this summer to visit his children, while his wife, **Gudrun**, will go to Denmark for most of the summer to visit her family. George reports that he is still busy practicing psychiatry and giving physicals to both commercial and private pilots. He thinks he does more flight physicals than any one else in the area. George was a member of the Air Corps and is a licensed pilot himself. He lists his hobbies as "bridge, travel, and womanizing."

Russ Hastings and **Mary** have recently returned from three weeks on the West Coast. Their son moved west recently to join two brothers of **Russ** and **Mary** who were already out there. . . . **Roger Williams** is recovering from a broken hip and is still using a cane, which he hopes to shed soon. . . .

Norm Krim has been busy collecting exhibits and archives for the new Raytheon Museum that

will open at the company headquarters this summer. Norm will have an office at Raytheon, where he will spend one or two days a week. He also spends a day per week at Pollack, where he served as president before "retiring." Pollack recently opened a new plant in Canton and has reserved a beautifully furnished corner office for Norm. We visited the plant, and it is beautiful—one of the three best switch-manufacturing plants in the world. Everything is automated, and the degree of accuracy and average quality level is almost unbelievable.

At the time of the committee meeting, **Ernie Massa** had just arrived from Florida, and said

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Technology Specialists
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David W. Rouille

he had to leave his wife behind to unpack the car. He asked that our annual spring lunch be moved up to early May. George Gahm and Frankie Frank (widow of Louis Frank) are looking in to getting a private dining room at the Newton Marriott for next year's meeting—probably on May 7, 1997, so hold the date. All Class members are invited, just contact Larry Stein or your secretary by May 1. Have a great summer!!!

Please send news for this column to: Carl H. Wilson, secretary; 50 Point Pleasant Rd., Webster, MA 01570; tel & fax: (508) 943-6066; e-mail: <chw34@aol.com>

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As sadly reported in the May/June issue, our faithful class secretary **Allan Mowatt** passed away last March 20. For our class it was an especially cruel month, since we also lost another active classmate, **Hal Bemis**, who in recent years had served as class agent.

Allan Q. Mowatt grew up in Swampscott, Mass. An outstanding athlete, he not only was stroke and captain of the MIT heavyweight crew, but for a time held the record (1 hr. 40 min.) for the ascent of Mt. Washington on



Allan Mowatt

foot from Pinkham Notch. After graduation, he twice won the New England singles sculling championship, and once also took the double-sculls title with his younger brother, Herman, who predeceased him. A Course VI man, Allan began his professional career adventurously, joining Harvard oarsman and friend Jim Erickson in a sea-salt operation on the Cuban island of Inagua. When some of the islanders started a revolution and seized the radio station, the company's officers and a few loyal workers escaped in a small boat; but the engine failed, and they drifted to Cuba, where they were arrested as revolutionaries because of the guns they carried. The U.S. consul helped get them out of prison. Allan spent the war years working for Westinghouse in Pittsburgh and Springfield. After subsequent stints at the Eastern Co-operative and at Raytheon, he founded the C&K Components electronics firm in Watertown, Mass., manufacturing plastic insulators. Some time after his retirement, he moved to California, and there he died peacefully, having survived several heart and limb operations during the past decade. Allan's long and effective service to our class began in 1970, and his column rarely, if ever, missed an issue of this journal. He was recognized for this work in 1991 by the Harold E. Lobdell, '17, Award. He is survived by a sister, six children, 16 grandchildren and a longtime companion, Kay Fletcher.

Hal L. Bemis grew up in Pennsylvania and lived most of his adult life in the Philadelphia area. In his Course XV undergraduate days, his manifest intelligence, innate dignity, and

quiet air of confidence stamped him as a future leader. After graduation, Hal joined the Campbell Soup Co. and spent the years before U.S. entry into WWII with its Canadian operation in Toronto. His Army record was distinguished: attaining the rank of lieutenant colonel, he received the Legion of Merit with oak leaf cluster, a Bronze Star, and the Croix de Guerre (France). Returning to Campbell in Camden, he rose to vice-presidential rank before leaving to engage in business enterprises of his own. In 1957, he founded the Jennings Machine Corp., and he was also associated with a number of other firms as an officer or a director. He served a term as president and then as board chairman of the Greater Philadelphia Chamber of Commerce. But that is only half the story, for he gave unstintingly of his time to many charitable and community organizations. He was a former chairman of the board of the American Cancer Society. The extent of his leadership in community affairs cannot be detailed here but can be appreciated from his entry in *Who's Who*. He embodied the motto *noblesse oblige*. MIT awarded him the Bronze Beaver in 1973. Hal died on March 7 after suffering a heart attack. He is survived by his wife, Jeanne Chatham Bemis, three daughters, and two stepchildren.

Charles W. Smith (Smitty) died October 9, 1995, at his home in Plainfield, N.J., and will be missed by his many friends. He was a chemical engineer who, after graduation, obtained a master's degree in chemical engineering practice and then spent three years on the teaching staff of the Practice School. In 1939 he went to work for Exxon and held a series of important technical and managerial positions over the next 46 years. He continued full-time employment until he was 70, an unusual record. For 36 years, he acted as an Exxon recruiter for engineering students from MIT and other prominent engineering schools, which led to his interest in engineering education. Smitty and his wife, Marcella, were married in 1940, and had eight children. Since his death, Marcella has moved to 5613 Alpine Rd., Raliegh, NC 27609-4001. Full of enthusiasm, and with an outgoing, confident personality, Smitty made and kept many good friends.

In the course of time, other members of the class will step forward to carry on the work of Mowatt and Bemis. For the moment, you are urged to communicate news items to either of the undersigned: **Thonet C. Dauphine**, president, 57 Alcott St., Acton, MA 01720-5540; tel: (508) 263-3494; **Walter H. Stockmayer**, acting secretary, Department of Chemistry, Dartmouth College, Hanover, NH 03755-3564; tel: (603) 646-2503; fax: (603) 646-3946; e-mail: <walter.stockmayer@dartmouth.edu>

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Writing in May as we approach our 60th Reunion, I think of the many contacts with acquaintances or barely known classmates, who have since become friends in the last 10 years. Everyone has exuded an aura of success in the art of living, without regard to position or financial reward. Some of your achievements in science, invention, development, construction, government or communi-

ty service, the military, and progeny have been recorded in these Notes, and probably many more have not been revealed to '36 secretaries. Hats off to all of you! Phoebe and I will have moved back East by reunion, and our temporary New Jersey address is at the end of the column. In Harding Township, surrounded by North Jersey suburbs, we have a choice of rural delivery out of Morristown, or a local post office box. Telephone calls to Santa Fe, (505) 988-2745, should still get announcement of our New Jersey number until year end.

Bob Walker (Course XVI) has lived with an above-the-knee prosthesis for years, and attended the 50th and 55th reunions, but may not make the 60th. Almost a year ago the device failed him; the fall caused a baseball-sized hematoma; a large blood blister resulted from the new leg; the nuisance persists, but he hopes to attend a grandson's wedding in Oklahoma. . . . **Py Williams** (Course X), responding to the mail canvass, supplemented his 50th biography (a VP and director of Robertson Paper Box, director of Connecticut Public Expenditures Council, and a number of other posts). Retiring in 1978, he and wife Mary returned to his family's home island in Penobscot Bay, dating from first settler (1774) Shubael Williams, and to one of its oldest houses, continuously occupied on his mother's side. Py is still sailing a 12-ft., wooden Herreshoff Bullseye, built in 1916. . . . An article in *Woodland Management*, spring issue, by **Pete Weinert's** wife, Jean, tells of and shows their building a 16-ft. birchbark canoe. First they felled a choice 20-inch diameter white birch in northern Wisconsin, stripped the bark, and split and bent the ribs, stern, and bow boards. Offspring dug jack pine roots for thread to sew the bark, just as the Chippewas did. A work of art.

Another report on **Henry Johnson**: his estate includes a \$6.4 million bequest to his scholarship fund, which, together with earlier gifts while alive, push the total toward an eight figure amount. A check of the Alumni/ae Fund office indicates that only about ten individuals have given as much—"a remarkable legacy," in the words of the office. At lunch a few weeks before Henry died, he made vague reference to bequests, but not such that **Connie Bouchard** and I had any idea of such munificence. With **Bill Hewlett's**, **Frank Schoettler's**, and other generous gifts from many classmates, it seems that 1936 must be near the top of all classes to date.

Cheers for the life of **Roy G. Thompson**, Course II, who died suddenly last September 18 at Pine Tree Golf Community in Florida, where we visited in our camper in 1988. Roy was a financial casualty in 1933-34. He went home to work in his father's print shop, inherited it, developed a more profitable stamp-making process, and retired as president of Sale-Niagara, in Buffalo. His interest in the Institute continued throughout. His widow, Eleanor, tells of an apparent heart attack and a severe blow to his head in falling. "He died suddenly and was buried at sea—there was no obituary or service—all as he wished." She expects to join him in the same fashion, and now is back to playing golf thrice weekly.—**Frank L. Phillips**, secretary, c/o Appleton, Van Beuren Rd., Morristown, NJ 07960 (temporary address)

37 60th Reunion

Our 60th Reunion Committee had its first meeting under the capable leadership of **Dick Young** and **Phil Peters**. The meeting began to explore ideas for a great get-together in June of 1997. Doing the "exploring" along with them were: secretaries **Bob Thorson** and **Len Seder**, and treasurer pro tem **Rutherford (Bob) Harris**, who is subbing for resigned treasurer **Ralph Webster**. (We hope Ralph has recovered from his ailment by now). Present in spirit were **Joe Keithley** and **George DeArment**, our reunion gift chairmen, and **Walt Wojtczak**, our class agent. (You'll be hearing from them). The reunion dates are June 5-7, 1997 (Thursday through Saturday). Among the ideas discussed was staying on campus (as 1936 did this year) and enjoying local activities, such as the Boston Pops, a class dinner, Boston Harbor cruise, a Cardinal & Gray dinner and Sing Along, a visit to MIT Endicott House, the Kresge lectures and luncheon on Technology Day, and visiting MIT departments. If you like any of these or have ideas of your own, drop one of your secretaries a line. (A few notes on your own activities would be welcome, but not required.) You will receive a letter on the plans as they are finalized.

Bob Glancy writes from Stroudsburg, Penn., to say that this spring, he finished his 15th year of tax counseling in the AARP program. He is also president of a small Golden K Kiwanis Club in his retirement community in Labar Village. "I am responsible for getting our speakers. Recently we had fascinating review of model railroading by an enthusiast, then a picture of the big band era by a music teacher with 26 years of high school and college experience, a talk on cancer by a retired director of the Cancer Society, and a lady minister who provides a night stopover for hikers on the Appalachian Trail." For our 60th Reunion, Bob suggests a repeat of one of the questionnaires used at an earlier one. Would you like that?

A "Lifetime Achievement Award" was recently conferred on **Frank J. Mather III** at the West Palm Beach Fishing Club for his dedication to the study of large pelagic fishes. According to the program of the evening, he is recognized throughout the world as the "Father of the Cooperative Game Fish Tagging Program." The citation continues: "As a biologist at the Woods Hole Oceanographic Institution, he developed the first sustained use of marine fish tags for bluefin tuna. In 1954, he helped implement a cooperative tagging effort between anglers and scientists, also one of the first programs of its kind. The practice of tagging marine fishes quickly became one of the most effective scientific techniques used to monitor the migrations, population, distribution, and general ecology of many economically important species of fish, especially the highly migratory tunas and billfish." There are more details; write us for a copy, all you anglers. Frank and his wife, Natalie, are in good health and divide their time between Key Biscayne in the winter and Woods Hole in the summer. In addition to all his scientific accomplishments, he is still a competitive fisherman!

Being 81 doesn't bother **Norman Mathews** of Salem, N.Y.; he is feeling fine, he says. Having retired in 1980 from the Bureau of Mines,

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where he was a physical scientist, he keeps busy. His latest project is improving the harvesting of hardwoods in the Northeast. The project will be managed by the Rotary Club of Salem in collaboration with the Salem-area Chamber of Commerce. The officers and foremen will be retirees who need something interesting to do in the wintertime. Good luck with your project, Norm.

Charlie Cardani from South Hamilton, Mass., and his wife, Jean, will be celebrating their 50th anniversary about the time you read this. He hopes to go to Columbia Falls, Mont., "to watch our 11-year-old granddaughter win first prize in the 4-H Club Fair. Her 'cow' (a steer) in her project now weighs about 900 pounds." Charlie reports that his health is fine, except for an occasional bout with pneumonia. He also tells sadly of the death early this year of Chester K. Nie of Shanghai, P.R. of China, with whom he had frequently corresponded. A letter from Chester's daughter said that he passed away peacefully without any pain. Chester received a master's degree in 1938 and retired after a career in research with the East China Electric Power Co. We extend our sympathies to his family.—Co-secretaries: Leonard A. Seder, 1010 Waltham St., 342-B, Lexington, MA 02173; Robert H. Thorson, 66 Swan Rd., Winchester, MA 01890

38

While we were attending our 1996 mini-reunion, H.J. McGillivray, at Indian Rock Beach in Florida, was busy working on his latest patent, the "Macwind Brace," a temporary structural member for bracing glass windows during hurricanes. . . . Russ Rossano was on an extended tour of Spain, Island of Mallorca, and France. . . . E and Frank Gardner were actively engaged in church work in Shelburne, Vt., and Frank was also embroiled as a member of their retirement community's sports committee in seeking to build an aquatic facility with lap pool, therapy pool, and jacuzzi. . . . Bill Shamban was continuing his business activity in Pacific Palisades, Calif.

Ed True returned to Searsport, Maine, at the end of May after spending the winter in Florida. In our July Notes we mentioned Henri Strauss' wife's serious illness. We were sorry to hear from Harold Strauss that she died in late April. They both have been consistent supporters of our class activities and MIT events.

Bertha Francis advised us that Justin Francis died on April 10, 1996, on his birthday. He was 82 years old and had been retired for over 27 years. He had worked as a naval architect and marine engineer for the U.S. Navy for 31 years.

Norm Bedford and Sol Kaufman, our 60th Reunion co-chairmen, had many things to consider in picking our Newport reunion site, one of which was Boston's Big Dig. Did you know that the Central Artery/Third Harbor Tunnel Project was approved by Congress in 1987, and funds were authorized in 1991 with a 2004 completion date? The eight miles of tunnels, providing an eight-lane underground highway from East Boston to Charlestown, from Chinatown to South Boston, and from the South End to the North end saw ground broken five years ago with peak construction

expected in 1998 at the time of our 60th Reunion. The *New York Times* reports that "not a single house has been taken, not a single family displaced, with the heaviest building going on in congested downtown." One part of the Big Dig—the Ted Williams Tunnel under Boston Harbor to Logan Airport—was opened to commercial traffic in December 1995, and eventually will be linked to the Massachusetts Turnpike.—Paul R. Des Jardins, secretary, 6251 Old Dominion Dr., Apt. 310, McLean, VA 22101-4807; tel: (703) 534-4813; Frederick J. Kolb, Jr., president, 211 Oakridge Dr., Rochester, NY 14617-2511; tel: (716) 342-3093

39

Ten MIT students received an average of \$5,959 each from the Class of 1939 Scholarship Fund. Class President Manning Morrill received thank-you letters from three of them.

Seventy-four MIT classes gave \$9,847,566 to the 1995 Alumni/ae Fund. Thirty-three percent of the Class of '39 participated. Five other classes equaled. Three other classes achieved 34 percent and one scored 35 percent.

Hewitt Phillips engineered and designed aerospace vehicles, model planes, a world-record glider, and two toy "Nerf" gliders. Inspired by Lindbergh's 1927 solo flight from New York to Paris, Hew built his first model airplane when he was nine. He exhibited one of his powered model airplanes in the 1936 Freshman Hobby Exhibit at MIT's annual Open House. During and after WWII, he directed simulation and analytical studies on the *Gemini*, *Apollo*, and *Shuttle* programs. He wrote more than 75 technical papers and his many honors include the President's Award for Distinguished Federal Civilian Service. When some Hampton, Va., high school seniors decided to break the world record for a glider of maximum wingspan that could glide at least 50 feet when launched indoors from a 10-foot high platform, Hew and colleagues from NASA helped. A glider with 30-foot, 6-inch wingspan resulted. The glider broke the world record and it hangs now, with record unsurpassed, in a Hampton Aeronautical museum. In 1995, a toymaker built a soft-foam toy "Nerf" glider that couldn't glide. The toymaker came to NASA and Hew Phillips and a colleague, who designed one soft-foam toy glider that could loop and do banked turns, and another that could glide straightaway. The toymaker proposes to mass-produce and sell both gliders, and on February 25, 1996, the Newport (Va.) *New Daily Press* devoted its front page, with pictures in color, and a whole inner page to a story titled "NASA Meets Nerf." Hew Phillips is married to Viola who, as homemaker and mother of three and grandmother to six, inspires and encourages her husband.

Manning Morrill and Connie attended the golf Masters' Tournament in Georgia during April. They expect to move into a Winchester condominium about June. . . . Joe Dana and Jean played tennis and skied in California and Switzerland. They saw Beatrice and Burns Magruder at the Boston Symphony, and they visit with Muriel and Smitty Curtis and Pam and Bob Pratt at MIT Alumni/ae meetings on the Cape. The Danas are readying their day-sailer for summer saltwater cruising.

Colonel Latimer MacMillan writes: "In March I expect to celebrate 50 years of joyous marriage to Trudy (the former Gertrude Hodges of Waycross, Ga.). I spent eight years developing the Santa Maria Homestake mine in Arizona and building its processing plant before they were sold. I am to be a director of the new corporation to operate this and other mines in Ariz."

Bill Pulver and Adie greeted springtime by (1) clearing winter's debris from their pontoon boat, (2) hitting a few chip shots, and (3) cogitating ontology. This secretary understands the two activities first-mentioned. But after observing numerous philosophical conclusions in 75 countries on planet earth, he can only admire Bill and Adie all the more for what they are accomplishing on the third.

Bob Touzalin and Aletta are boating in England, this time on a canal built hundreds of years ago by Romans. They expect to attend a London meeting of the British Pewter Society. They'll visit in Germany and Switzerland before returning to Naples, Fla. Bob says Sam "Spec" Card, '40, is organizing an MIT mini-reunion for early 1998 at Sanibel or Captiva (islands) near Fort Myers, Fla.

The John Alexanders are to be honored May 11, 1996, at Kirkland on Lake Washington when they celebrate the 50th anniversary of their wedding. Hilda and I expect to attend.

Other good news: No obits to report.—Hal Seykota, secretary, 2853 Claremont Dr., Tacoma, WA 98407-2332

40 Class President Bruce Duffett writes that, after a spectacular winter in Santa Fe, he and his wife are returning to Erie, Pa., for the next seven months. He also mentions that he has

heard from Joe Jefferds, and that Jack Schaum and Ed Hellier both expect to send me some info for these notes. In addition, Bruce notes that Sam Card is working hard with Floridian classmates to sponsor a mini-reunion in Florida in February 1998.

Today, May 7, I received a packet from Sam "Specs" Card with a full story of the progress on that mini-reunion. The dates have been set as Thursday through Monday, January 15–19, 1998, at the Sundial Beach and Tennis Resort, Sanibel Island, Fla. Classes from 1937 through 1963 will be invited. It will probably include an academic seminar program with MIT faculty members as speakers. A questionnaire will be sent to every sixth name on these class



Bill Stern, '40

recently received a Class of '05 relic intended for presentation at the 1905's 50th Reunion. The relic has now been passed down to a first-generation descendant of that class. Ed continues, "I received a phone call from an author compiling a book on Glenn Miller. He wanted my recollections of the man and his orchestra, claiming that my name appeared in Glenn's diary and that I had hired the band for a Tech dance. I had no recollections to convey, but I am happy to report that my date for the dance that evening is still with me today. Some dance!"

A note from his widow tells of the death on December 2, 1995, of Fred John Johnson in Englewood, Fla. Mrs. Johnson writes that Fred valued his MIT education greatly. He was an engineer for E.I. Du Pont in six locations, retiring as the Moberly, Mo., plant manager in 1979. Fred served in WWII and the Korean War, achieving the rank of captain at Wright Patterson AFB in Dayton, where he was a procurement officer. He was an elder in his church, and chaired the personnel and building expansion committees, and served on the Council of Peace River Presbytery. The Class extends its sympathy to Fred's family.

A note from Audrey Ellis Saracco, the class programs coordinator in the Alumni/ae Office, tells of services offered by the Institute Archives. Helen Samuels, head of Special Collections welcomes any materials that may be of historical interest to the Institute. In addition, Helen would like us to know that Archives is available for research requests on indi-

lists—a total sampling of about 2,500 alumni/ae. Specs has an active committee to assist him. Members from our class are Doug Eckhart, Don Harper, Norm Klivans, Geoff Roberts, and Phil Stoddard. As the project develops, we will keep you informed.

Sally, (Mrs. Bob) Bittenbender called me to say that Bill Stern had run in the Patriots' Day Five-Mile road race. The local newspaper, the *Lexington* (Mass.) *Minuteman*, wrote, "The star of the day was 76-year-old Bill Stern, who crossed the finish line in 48:48. Stern has overcome several injuries in the past few years and recent radiation therapy to keep his string of Lexington races alive. He has been running in the event since 1981."

Edward Wallace sent a note. He and wife Ruth established a scholarship fund in memory of her father, Myron Helpner, '05. Ed

ClassNotes

viduals. Contact her with or for information.

And, keep those letters and telephone calls coming to Richard E. Gladstone, secretary, 250 Hammond Pond Pkwy., #1205-S, Chestnut Hill, MA 02167-1528; tel: (617) 969-5161

41

Sam Fry writes from Seattle, Wash.: "I am looking forward to participating in our 55th Reunion along with local class members, Mac Gardiner and Robert Wallace Blake." (This

info will be superfluous for those who attended the reunion). He continues, "I am still actively building trails, climbing mountains, wind surfing, and generally having a great time!" Sam enclosed an article from the *Boeing News* that reports that Boeing Defense and Space Systems Group donated two high-quality telescope mirrors, 41.5 and 30 inches in diameter, to the Battle Point Astronomical Association. At the ceremony transferring ownership of the mirrors, Mac Gardiner, president of that nonprofit astronomy association, said that the mirrors would be the centerpiece of their planned observatory and education center at Battle Point Park on Bainbridge Island. (Your secretary, whose high school science project required almost a year to grind, silver, and mount a 6-inch telescope mirror, appreciates that Mac is managing an impressive, and world class observatory!)

MIT also transmits two sadder pieces of news: James J. Holley died in Farmington Hills, Mich., after a long battle with cancer. After graduating with a degree in mechanical engineering, Jim joined the Army Air

Forces in April 1943 and was discharged as a captain in



December 1945. Spot checks on his career (from MIT Alumni Registers): 1948, sales engineer, U.S. Electric Motors of NYC; 1961, district sales manager, McGraw Edison Co.; 1975, VP, Knaus, Holley and Schiller; 1984, president, Holley & Upleger, Highland, Mich. He retired in September 1994 as national sales manager, Myron Zucker, Inc., Royal Oak, Mich. He was predeceased by his wife, Patricia, and is survived by two sons, a daughter, a brother, and two sisters.

Carla J. Vitale of Boxford, Mass., informed MIT that her father, Carl Wickstrom, passed away August 7, 1995. No other survivors were listed. From January 1944 to March 1946, Carl was in the U.S. Navy and was discharged as a lieutenant. Over his career, he held various engineering positions in several cutting and die companies in the Boston area, and by 1975 was VP of United Die Corp., Beverly, Mass.

The Class of 1941 expresses its sympathy to the families of these departed members. Our October Class Notes are scheduled to be written shortly after our much anticipated 55th Reunion, which should provide copious grist for the mill. 'Til then—Charles. H. King, Jr., secretary, 7509 Sebago Rd., Bethesda, MD 20817-4839; tel: (301) 229-4459; e-mail: <olspace@aol.com>

42 55th Reunion

From Ed Vetter: "It was sobering last October when I was transferred from Corporation life member to life member emeritus!"

He still lives in a big house in Dallas with a cat and still gets to travel with a couple of boards who "don't mind directors who are 75 years old." Ed says his political days are over, but he has copious days of hunting and fishing.

Lou Rosenblum and Bill Denhard are planning our 55th Reunion, which will be at the Doubletree Islander Hotel in Newport, R.I., from June 3-6. We'll be hearing more from them soon. They will appreciate any suggestions from all classmates and spouses, of course!

Two obits: **Rene Bourguet**, who had four daughters, four sons, and 16 grandchildren; and **Harry Clarke**. Our condolences to their families.—Ken Rosett, secretary, 281 Martling Ave., Tarrytown, NY 10591

43

Responding to a recent item in Class Notes, **Greg Gagarin** issues a disclaimer. Not a drop of Romanov blood flows in his veins. He's noble, he says, rather than royal.

Greg has visited Russia a number of times, both as a tourist and on industrial development business. In 1899, his grandfather founded the (now) St. Petersburg Technical University, patterned somewhat after MIT. Its alumni include many well known Russian scientists and engineers. The grandfather's house, about 160 miles south of St. Petersburg, is now listed in the Russian national registry of historic buildings. One business trip involved trying to reconstruct the U.S. Navy's activities in WWII lend-lease programs. Greg talked to several pilots who received and flew U.S.-built aircraft. He

strongly recommends a visit to Moscow's new Museum of the Great Patriotic War, opened in 1995. There are some very dramatic displays, including a number on American and British assistance.

Two obituary notices have come in, with minimal information. **Dexter K. Bowers** (Course XIII) Essex, Conn., died September 15. . . . **Alvin C. Brodie** (Course XIII, later degrees in Course VI) passed away November 1 in Dover, Mass. We extend our sympathies to their families.

George Freedman sends some interesting information about **Arthur Vershbow** (Course II) and his longtime association with the Boston Athenaeum. Arthur is a serious collector of rare books, owning several thousand of them, many from the time of Gutenberg. In addition, for the past 18 years, he has been president of what is arguably America's most prestigious private library. Other activities include membership in the Club of Odd Volumes (a rare book society) and the board of directors of Boston's Museum of Fine Arts. George says Arthur's important contribution to Boston's cultural life shows that "we MIT folk are not just techies, nerds, and captains of industry. We can excel in the 'higher things' as well." Well said!

Thanks, Greg and George. I could use many more items like yours.—**Bob Rorschach**, secretary, 4727 S. Lewis Pl., Tulsa, OK 74105-5138

44

In the April 1996 Class Notes, we had an article on **C. Reginald Robba** of Columbia, Md., depicting his experiences during WWII while working on the atomic bomb at Oak

Ridge, Tenn. The newspaper clipping was courtesy of Tom Bell, '47. Tom's recent note brought the sad news that Reg passed away in Sarasota, Fla., on February 25 from prostate cancer. . . . **John E. Fries** sends word that the family moved in June '95 to Phippsburg, Maine, on a small cove south of Bath on Casco Bay. The call to return to salt water became too great to resist and they were looking for another adventure.

Joe T. Lester, Jr., and his wife, Margaret Clark Lester (Wellesley '48), have been presenting skits about historical couples. They have done Martha and George Washington more than 65 times. Now they are working on Dolly and James Madison. The skits are presented to senior groups, schools, retirement homes, AARP, etc. . . . Aerodyne Research, Inc., of Billerica, Mass., has elected **John H. Kellogg** chairman of its board of directors. John will work with the company's staff to commercialize Aerodyne's new products. John earned a BS in mechanical engineering and graduated from Harvard Law School in 1951. He is founder and co-founder of a number of technology firms and founded the law firm Kellogg and George in 1977 where he served as its principal until he retired in September 1994. John resides in Concord, Mass., with his wife, Annabelle.

Arthur K. Hoge passed away on October 19, 1994, in Bristol, Conn. He was retired from the Torrington Co. and is survived by his wife, Dorothy. . . . **William T. Seales** passed away in Concord, N.H., no date given. He was born in Kilmarnock, Scotland. A graduate

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of Boston University Medical School as well as MIT, he specialized in anesthesiology at the Mary Hitchcock Hospital in Hanover, N.H. During WWII he served in the U.S. Army. He is survived by his wife, Elizabeth, two daughters, and six grandchildren.

James S. Mulholland, Jr., has established the Catholic Information Center on the Internet (CICI) as of September 1995. The CICI is operated by the Vatican's Path to Peace Foundation, based in New York City. Path to Peace's goal is to support the Holy See's mission to the United Nations, keeping the moral standards and the message of the Gospel before the international community. "The ancient Romans built a system of roads that united Europe for the first time and the Church's missionaries used them to spread the Gospel. Today, we intend to use the information superhighway," says Mulholland. The Holy See made Mulholland a knight commander of the Order of St. Gregory—the highest honor a layman who is not head of state can receive—in part for his help in underwriting the computerization of the Vatican Secretariat of State. The CICI's Internet address is: <<http://www.catholic.net>>.

Lloyd Marks, '71, sent word about **Bernard (Hy) Rabinowitz** and his work as chairman of the board of United Healthcare System, a major not-for-profit health care provider for Newark, N.J., and its surrounds. One of the key components of United Healthcare is the Children's Hospital of N.J. where Dr. Marks is chief of pediatric cardiology. United Healthcare recently opened the largest outpatient health care facility in New Jersey at East Orange. Rabinowitz gave a stirring keynote address at the ribbon cutting and addressed some important aspects of health care delivery in these trying times.

We wish to extend our deepest sympathy to the families of our departed classmates. They are gone but not forgotten.—Co-secretaries: **Frank K. Chin**, 221 St. Paul St., Brookline, MA 02146; **Louis R. Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

45

In the May/June issue, we reported on **Frank Gallagher's** sojourn to Nova Scotia. As we write these notes, the same foursome, plus one, are traveling through the Cotswolds in

England. The "one" added is **Dee Gallagher** who advised Frank that he would not be going to the UK without her! More later.

In February, **Jim Levitan**, our 50th Reunion Gift Chairman, heard from **Isabel Vegas** in Caracas, Venezuela, that her husband, **Juan A. Vegas**, died August 4, 1992, after a two-year bout with cancer. Our records indicate that Juan was employed in the Comision Nacional De Urbanism with the Ministerio De Obras. Sounds like urban planning to me!

Joe Neschleba advises that he and Eleanor, together with son-in-law, Michael, '69, will be attending eldest grandson, Patrick's, graduation from Stanford in June.

To prove that we can be current and up to date, **Vince Butler** had dinner in San Francisco last evening with Heather and **Bill Blitzler**. Bill continues as a consultant with Lightolier and was in San Francisco on business. Vince, as an unofficial tour guide, showed the Blitzlers San Francisco sights through the eyes

of a native. We understand, however, that Vince uses, as his guide, a booklet that **Phil Pocock** of Ottawa, Ontario, sent him within the past six months!

The Archives Office at MIT is available for research requests on individuals. If any of you wish to make use of this facility, please let me know and I'll make the arrangements. Lastly, how about some news!—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

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Thanks to the energetic and enthusiastic efforts of **Bob Hoffman** and his 50th Reunion Committee, 140 people have registered to attend. Most of these people will

attend both the Cambridge campus events June 6–9 and our events in Newport, R.I. from June 9–12. By the time this printed edition reaches you, we will already have completed our 1996 Commencement Procession wearing our cardinal red blazers.

John Maynard and **Dan Cooper**, editors of our 50th Reunion Yearbook, have assembled about 200 biographies of class members. Their book includes a lot of pictures and memorabilia. These books will be distributed at the reunion and will be mailed to many people.

Ted Heuchling's 50th Reunion Gift Committee has raised about \$4 million from class members. Thanks to all of you for your help and continuing support.

Priscilla and **John Norton** will celebrate their 50th wedding anniversary in 1997. They expect to attend our 50th Reunion. John is retired from General Electric and is enjoying a pleasant life in Greenville, S.C.

We have recently learned of the death of **David Allmond Kleinman** on March 23, 1988. David was employed by AT&T's Bell laboratories in Murray Hill, N.J. David is survived by his widow, **Ruth Kleinman**, who

ClassNotes

lives in High Bridge, N.J. . . . We regret to report the death of **Mack Elwood Worthen** on June 20, 1995. Mack was a design specialist in the Aerospace Group with the Boeing Co. in Seattle, Wash. Mack is survived by his widow, **Jean Worthen**, who lives in Bellevue, Wash.—**Ned Tebbetts**, secretary, 9 Jerusalem Road Dr., Cohasset, MA 02025, tel: (617) 383-1662

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50th Reunion

Please send news for this column to: **R.E. "Bob" McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Denny McNear met with **Peter Saint Germain**, **Sonny Monosson**, **Graham Sterling**, **George Clifford**, **Bill Maley**, **Harold Ottobriani**, **Milton Slade** and yours truly to

review communication between the reunion gift campaign for funds for MIT and the reunion committee plans for fun at our 50th Reunion. Both classmates and staff members of the Alumni/ae Association were at the meeting since both groups are working together. Peter outlined plans and the tentative schedule for the gift campaign. He is recruiting other classmates to assist him. Based on my years of experience in asking for contributions to MIT, I do not expect anyone will be volunteering until Peter calls them. Then the volunteers have always helped to the extent that they



Robert Hoffman carries the class banner out of Killian Court with his wife, Marion, with classmate Joel Feldstein close behind, as the Class of '46 departs their "day in the sun" at Commencement '96.

could. Let's surprise him—how about a few volunteers calling Peter?

The campus portion of the reunion, which begins June 4, 1998, will include a buffet and the Boston Pops, graduation exercises, and Technology Day. Plans to go to Bermuda after the reunion are well along. There will be an option of taking a cruise ship (\$1,200–\$2,000 per person, depending on choice of cabin) or flying to Bermuda. Pre-reunion activities will begin May 31 at the Samoset in Rockport, Maine, or the Equinox in Manchester, Vt.

The committee is planning a yearbook with biographies collected from classmates. Editorial assistance is needed for sections related to all of the class. If you are interested in volunteering, let Sonny know. There is no need to live near Boston, but e-mail or a fax service would be very useful.

Tom Pawel received the Officer's Cross of the Order of Merit from the Federal Republic of Germany at a reception in San Antonio. Tom has served as honorary consul of the Federal Republic of Germany in San Antonio. Tom's wife, Nancy, teaches ceramic arts and is widely known for the beauty of her ceramic pieces. . . . **Jim Guida** wrote that he finally recovered after an accident with a radial saw. His left hand is only partially useful. . . . **Sydney Crook** drives his 1928 Model A Ford on tours. He has served on the New London, N.H., planning board for 13 years.

Roland Nagy retired in 1992 after 30 years at Foster Wheeler Corp. His last assignment was on the editorial staff writing a history of the company. He and his wife, Cathy, have moved to Williamstown, Mass., in the beautiful Berkshires. They enjoy the scenic beauty and the Williams College campus with its myriad cultural activities.

Please send news for this column to: **Marty Billett**, secretary, 16 Greenwood Ave., Barrington, RI 02806; tel: (401) 245-8963

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Early in April, my answering machine came to life with a message from **John Horton** announcing he had just emerged from the hospital after a prostate operation. He had read my May/June 1996 column in which I stated that, after heart bypass operations, **Earl Eames** and I were doing well. John wanted me to know that heart bypasses are old hat, everybody has them, nobody boasts about them, and that I shouldn't dignify them by mention in the column. But a prostate operation!—now there's a topic to boast about! But John, around these parts, prostate operations take 20 minutes standing up in the doctor's office, following which the patient goes bowling.

Five years ago, the October 2, 1989, issue of *Forbes* magazine reported that Mark Jordan was the designer of what *Forbes* called the "hottest car in America, the Mazda MX-5 Miata." At the time, buyers were willing to pay double for the car. Now, the April 1996 edition of *Consumer Reports* heaps high praise on the current version of that same car. I bring this up because Mark Jordan is the son of **Charlie Jordan**, retired VP for design at General Motors. Charlie himself designed many winners in his time including a Fisher Body Napoleonic coach and the classic 1959 Cadillac.

Joseph Aaron Stern, founder and chairman

of the board of the Bionetics Corp., Hampton, Va., died on January 31. Dr. Stern, a lovable whirlwind in the eyes of many, had a list of accomplishments exceeding the space limitations of this column. A contamination expert, he founded Bionetics in 1969 to provide biological sterilization for the Viking project's first landing on Mars. Among his accomplishments, Stern successfully lead Bionetics in completing over 680 government contracts. He is survived by his wife of 45 years, Phyllis, two daughters, a son, and seven grandchildren.

E. Beale Wilson, AIA, whose architectural firm is located at 11 Beacon St., Boston, died April 9, 1995. The business is now owned and directed by his son, Thomas T. Wilson. I regret the lack of further information.

William S. Lewis died November 10, 1995. He was the retired proprietor of a bed and breakfast in Cornish, N.H., known as The Chase House. Mr. Lewis' wife, Barbara, provided the preceding information.

Clinton O. Chichester, a professor in the Department of Food and Resource Chemistry at the University of Rhode Island in Kingston, died November 12, 1995. I have asked his wife to provide more information; if she does, I will include the information in this column.

On behalf of the class, I extend our most sincere condolences to the families of these four men.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192; tel: (617) 449-1614

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Pat and I spent a day or so in Buenos Aires before boarding our cruise ship there. (Would you believe, "The Love Boat"?) While there I was able to reach **Mike De Mayo** who retired from business there earlier this year.

One of his enterprises, Telecopia SA, a distributor for Ricoh fax machines, had lost most of its profitability. With partner **Eduardo Lonardi**, he also ran the metallurgical firm, De Mayo-Lonardi, that produced evaporators, I believe he said. Mike has 6 children and 16 grandchildren. He likes golf and travels frequently. I was unable to reach **Eduardo**. I tried to reach **Alfredo LanaSarrate** in Montevideo, but was unable to get a number; and in Rio, I found a number for **Haroldo Falcao** but no one answered.

In the July version of this *persiflage*, I awarded **Virginia Stevens Small** the title of classmate who had commuted the farthest to MIT, having commuted from Andover. I have now heard from **John Bickford** with regard to his wife, **Anne Rosie Bickford**. Midway through her fifth year (you remember that Course IV was a five-year travail in our era.), Anne married John and moved to New Britain, Conn.—John's place of employment and 100 miles from school. John continues, "During the spring term in 1951 she spent Wednesday through Saturday as a student/housewife in New Britain, and Sunday through Tuesday as a student/daughter in Cambridge." This last term was primarily one's thesis, but gives Anne the title—at least in the four-day-week category. For more on Anne and John, see my April '96 version of this *badi-nage*.

Hank Sharp sent me a copy of a certificate

proclaiming, "1996—18th Annual Marathon, Henry Sharp Jr., Half Marathon Third Place, Men's Master V." On the back of the certificate Hank wrote the remainder of the news for this column. He included the sad news that **Norm Tisdale** and **Peg** lost their older son, **Norm III**, to a sudden heart attack last September. It was a devastating loss. Their family is very close, all work together in the retail furniture business with two stores in Valencia, near Pittsburgh. Norm still gets to the golf course each week.

"Speaking of furniture, **Freddie Mellin** (Carl F., Jr.) owns and runs the F.W. Lombard Co. in South Ashburnham, Mass." They make the finest wooden chairs and have supplied chairs to MIT. Freddie and Tom Kelly, '51, recently went on a 10-day golf vacation—one of those deals in which you play 360 holes in 10 days on 10 different golf courses. . . . **Jim Cooney** of Falmouth, Maine, is having a hard time with asthma, especially when the barometric pressure drops in advance of a storm.

Jane and **Milt Rand** travel to Europe and to visit their kids, they have one on both coasts. Son Jim was recently installed as the pastor of Presbyterian church in Milwaukee. They recently acquired three grandchildren in the space of about 48 hours, twins in Philadelphia and one in St. Louis.

Freddie continues, "We recently had the MIT Lacrosse team here for four days of their Spring Trip for the 11th consecutive year. But only six stay with us. I permit other alumni to host the rest of the team. Having at last reached 70, I wanted to do really well with my cross country ski races, but the weather did not cooperate in Sun Valley. At -24° F, the snow was like skiing on sand—very slow. I finished the 30K, but it took 5 hours, 8 min. The weather was kinder at Mammoth: I did the 21K in 2:35, my best time for that race (!) and not too bad for a guy who lives at sea level." Freddie, Jim, and Milt are Hank's brother Dekes.—**Robert A. Snedeker**, secretary, Seven Mashie Way, North Reading, MA 01864; tel: (508) 664-1738; e-mail: <103244.1541@compuserve.com>

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Edward A. Handy informs us that he is continuing as the community development block grant director for Cambridge. He is still trying to find the time to write the book, *What Really*

Happened at Stalag 17.

As busy as he was prior to retirement as an Air Force chaplain, **Robert C. Lewis** still plans and conducts services. He and his wife attend a few plays, concerts and generally enjoy retirement in Sun City Center, Fla.

Sadly we have to report the passing of **Allen Elston** on January 15. We wish our sincere condolences to his wife, **Iris**.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368; e-mail: <greenfld@tiac.net>

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45th Reunion

Hon C. Lee, managing director of Hyson Development Co., Ltd., Hong Kong, has been made a director of Imperial Chemical

Industries. He is also a director of several well-known Hong Kong businesses. Lee obtained an MS degree in electrical engineering from Stanford after leaving MIT and worked for Westinghouse and RCA before returning to Hong Kong in 1976. . . . **Tim Brown** writes that he keeps the books and does the taxes for the girl's camp founded by his grandmother in 1917, now run by his wife, Bunny. Tim says he has finally become used to the ice and snow of western North Carolina where he lives, and where his second son, Mike, was to be married Memorial Day weekend. The young couple will live in New York City.

Reunion chairman **Stan Sydney** and class president **Bob Lurie** report that over 120 reservations have been made at the Hershey Hotel, Hershey, Pa., for our reunion October 24-27. On Friday there will be a tour of Gettysburg and Saturday tours to Amish country and Indian Echo Caverns on the Hummelstown railroad. That evening there will be a formal dinner and dance (black tie optional) that should rival the Marble House dinner dance at our 35th Reunion in Newport. The reunion committee recommends that you make reservations at the Hershey Hotel at the earliest possible time. This is our last big reunion until our 50th in Cambridge in 2002!—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301; e-mail: <rflacey52@aol.com>; listserv: <mit1952@mitvma.mit.edu>

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Please send news for this column to: **Joseph M. Cahn**, secretary, 20 Ocean Park Blvd., Unit #9, Santa Monica, CA 90405; tel: (310) 396-6322; fax: (310) 553-0687; e-mail: <jmc20@aol.com>

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Word has come from **Roy Riedinger** that he has retired after 36 years at Proctor & Gamble. During his tenure he had various assignments, but his last five years involved extensive travel around the world. He got to like the travel so much that now he is doing it on his own, with his wife, Margy. . . . **Marty Brilliant** writes that on the date he received the

April issue of *Technology Review*, and read in this column about his continuing progress toward a doctorate in economics at Rutgers, he formally withdrew from the program. His reasons, he says, are (a) Rutgers is not MIT; (b) you can't go home again; (c) he doesn't have time to do everything he wants to do. So now he is concentrating on his family, the stage, his computer, and learning economics instead of cramming for exams. . . . **Jim Hyde**, who is director of the Medical College of Wisconsin, received the Annual 1995 Zavoisky Award in Electron Paramagnetic Resonance Spectroscopy last September at the Fourth Annual "Modern Development of EPR" Workshop in Kazan, Tatarstan. Jim was cited for his "outstanding contributions to the development of instrumentation and methodology of electron paramagnetic resonance spectroscopy." He was chosen from many nominations solicited from international experts in the field.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430

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Dennis Shapiro has been inducted onto the board of governors of Hebrew Union College-Jewish Institute of Religion, the nation's oldest institution of higher Jewish education and the academic and professional leadership development center of Reform Judaism. Denny is chairman of the board of Lifeline Systems and also is a director of Argus Software of Redwood City, Calif., and HealthDrive Corp. of Newton, Mass. He is a trustee of Boston's Beth Israel Hospital, Nantucket Cottage Hospital, Temple Israel of Boston, and Congregation Shohrat Ha Yam on Nantucket, is a member of the corporation of the Center for Blood Research and Massachusetts General Hospital. At MIT, he is on the Corporation Development Committee, the Libraries Visiting Committee, and was president of the MIT Club of Boston in 1993-94.

Ed Ehrlich reports that he broke his leg this past winter. It seems he climbed a 7-ft. snow bank to retrieve a trash can tossed there by the trash collectors and lost his footing

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on the way down. The damage was done when he landed on ice. Ed says that he has a metal plate with numerous screws, some of which will have to be removed. When we talked with him, he said he was getting around, and while walking distances still was not possible, he was not planning to give up golf this summer.—Co-secretaries: **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21042; **Roy M. Salzman**, P.O. Box 197, Rockport, ME 04856-0197

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An exhibit of **Richard Bertman's** sculptures was celebrated with a reception at the MIT Museum on January 25. Richard is an architect by profession and a founding principal of CBT/Childs Bertman Tseckares. CBT recently won a major project in Bermuda to design a new, mixed-use development that will include an office and retail building, townhouses and villas, and a marina.

Thomas Comparato has been working in Washington on the National Maglev Initiative for the past four years. He is now back at the Volpe Center in Cambridge heading up the Airport Surface Projects Office. Thom has three grandchildren. . . . **John Cronin** retired October 1995 after 29 years with Pfizer, Inc. His most recent position was controller of Pfizer's Information Technology Division. John's future activities will include sailing, travel, and volunteer work. . . . **Phillip Birbara** is the senior principal scientist working



Is it a dog? Is it a pig? About the time the movie Babe was nominated for an Academy Award in the U.S. (late last winter), Anneliese and John Tisdale, '54, were in New Zealand watching a sheep-dog trial, as part of an MIT Alumni/ae Travel Program tour. At the Agrodome, a working farm near Rotorua, the sheep are gently herded into a pen by a trained dog responding to human whistles and calls.

Edgerton Award Goes to Class of '57 Professor

An economic historian and residence housemaster with a remarkable record of creating new courses and participating in the Institute community has been named the 1996-97 recipient of the Harold E. Edgerton Faculty Achievement Award. Associate Professor Anne McCants of the Department of Humanities, holder of the Class of 1957 Career Development Professorship, was chosen by her faculty colleagues for the award, which recognizes junior faculty members for distinction in teaching, research, and service to MIT.

As noted in the award citation, McCants's field of research is early modern European social and economic history, with a special focus on the Netherlands in the seventeenth and eighteenth centuries. In particular, she has studied the diet and economic status of orphans in seventeenth century Amsterdam, to uncover how the Dutch handled questions of social welfare and entitlements, and how they balanced free markets, private charity, and government relief. The selection committee noted that her work has been "highly original in its combination of nutritional, statistical, and economic analyses with the more traditional analyses of the historian."

McCants, who holds degrees from Mount Holyoke College and the Los Angeles and Berkeley campuses of the University of California, joined MIT's history faculty in 1991 and was promoted to associate professor in 1995. During one three-year period, she created nine new subjects—

including a freshman seminar, survey subjects in early modern European history, upper-level European history subjects, and a graduate colloquium at Radcliffe College. The selection committee noted that she has "greatly invigorated teaching about the pre-industrial world at MIT, and she has worked hard to integrate economic data with cultural and literary texts to show how historians work to combine different forms of evidence."



ANNE MCCANTS

At the April faculty meeting, where the award was announced and McCants received a standing ovation, President Charles Vest joined the applause and commented in particular on her work as housemaster of Green Hall. Vest noted that he could "testify first hand that she and her family maintain a truly extraordinary environment for the residents of that hall."

In addition to her teaching, research, and living-group commitments, McCants has an extensive record of service to the MIT community. She is the advisor for students with a major or humanities concentration in history, the departmental UROP coordinator and chair of the curriculum committee, a member of the Computers and Humanities Group and of CUP (the faculty Committee on the Undergraduate Program), and the MIT faculty representative to the Harry S. Truman Scholarship Foundation and to the board of trustees of the Technology Children's Center, and has held most of these positions for several years. □

in environmental control in space technology for United Technologies Corp. in Windsor Locks, Conn. He has designed life support systems for space for the past 30 years and has 35 patents.

Walter Conrad, Jr., has a construction contracting business in Chesapeake, Va. Walter has two children, Jennifer and Paul, and a grandson Augustus Conrad. . . . James McGrady is retired from Cytex Industries where he was safety and environmental engineer. He lives in New Jersey and in his motor home when touring the country. . . . Frank Spada teaches electronics at Wentworth Institute. His daughter Joanne is engaged to marry Michael D'Agostino in October.

Please send news for this column to: Ralph A. Kohl, co-secretary, 54 Bound Brook Rd., Newton, MA 02161; e-mail: <kohl@ll.mit.edu>

57 40th Reunion

Alex Bernhard writes that he is still a partner at Hale & Dorr, still chairman of the

Massachusetts Eye and Ear Infirmary, and still on the advisory board of the American Repertory Theatre in Cambridge. More interesting is the news that he is a grandfather for the first time and that this is the first daughter born in four generations of Bernhards. . . . David Lukens is at Shimer College, a small liberal arts college in Waukegan, Ill. The college uses great books and original sources rather than textbooks, and no class is larger than 12 students. The pay is low, but the teaching is fun (but exhausting). He also serves as dean of students.

Prentice-Hall has published a book, *Industrial Materials*, a two-volume technology text, by David Collins and Thomas Vasilos. Both are professors at the Lowell campus of UMass. . . . Joel Schiffman retired from the practice of orthopedic surgery last year. He writes that he has not yet had time to start on any retirement activities. One daughter is in pediatric residency at UC/San Francisco, and the other does environmental consulting for the EPA in Alexandria, Va.—John T. Christian, secretary, 23 Fredana Rd., Waban, MA 02168; e-mail: <jtchrist@world.std.com>

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Michael Balderson returned to Boston last summer from Hawaii for the first time in 20 years. He and Joyce visited his former roommate Carl

Borchert and wife Karen on Martha's Vineyard for a great vacation. One of these years he plans to make the 5,000-mile trek back for a class reunion.

The next one, our 40th, promises to be outstanding. Now that he has retired from Polaroid, reunion chairman Dick Rosenthal can devote all of his energies to planning the big event. He has already set the location, the Newport Harbor Hotel and Marina in Newport, R.I. With the new format for commencement, Technology Day, and reunions, we will have the off-site festivities on Tuesday, Wednesday, and Thursday before the on-campus events. Mark your calendars for June 2-4, 1998—more details in the coming months.

Herb Kavet has retired (again) after selling Ivory Tower Publishing to a public company. Now he divides his time between serious stuff like skiing, wind surfing, and biking while amusing himself by continuing to write humor for other publishers. This is obviously a hereditary trait as older son Gregg has written three *Seinfeld* TV shows while also publishing a business consumer guide. Younger son Matt is president of Boston-America Corp., and Karen volunteers for Metro-West.

On March 15, **Jens Hanson** was honored on his 60th birthday by a performance of 75 musicians featuring a retrospective of his compositions dating from 1974. Following an undergraduate engineering degree, he pursued music, receiving a doctorate from Yale. He joined the University of Windsor (Ont.) School of Music in 1968 as a lecturer, became a full professor within a few years and has remained there since. Hanson describes his composing style as "North American Modern." He was among the first classical composers to use a sequencer, or midi synthesizer, with a Macintosh computer to write music but has not abandoned writing the notes down by hand. Every Sunday he hears his Gloria Patri sung at the Central United Church, where he is chairman of the board. Although he does not perform himself, he has heard all 59 of his compositions performed. He stated that, "I went into music because I wanted to know how music works. Now that's what I want my students to understand."

Herbert Waxman has been named senior VP for education by the American College of Physicians (ACP). In this role he is responsible



Herbert Waxman

for educational programs and products for internal medicine. He also oversees ACP's scientific policy activities, such as the development of practice guidelines. Herb continues as the associate editor of ACP's innovative Medical Knowledge Self-Assessment Program. A Fellow of ACP with nearly 30 years experience as a medical educator, Herb joins ACP from Albert Einstein Medical Center in Philadelphia where he was chair of the department of medicine and residency program director in internal medicine. Herb was also senior associate chairman of the department of medicine at Temple University School of Medicine, also in Philadelphia. More information on his career appeared in the April '95 issue of this column.

Please send your news.—**Gary Fallick**, secretary, 4 Diehl Rd., Lexington, MA 02173; e-mail: <fallick_gary@waters.com>

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Calvin Cambell writes, "I graduated in chemical engineering and, while I am extremely active at Williams College (1956 graduate) and Michigan Law School (1961 graduate), I have never returned to MIT reunions and know few, if any, classmates. I

had hoped to attend the 35th Reunion but was unable to. As our class records show, I have contributed every year (I believe) since graduation." Calvin is president and CEO of Goodman Equipment Corp. in Bedford Park, Ill. Thanks for the note, and we hope to see you at the 40th (never too late to start!).

One of the few (have gotten just two in two years) e-mail messages comes from **Lou Cohen**, who reports retiring from Digital Equipment four years ago and "only then did I complete a book on quality function deployment (Addison-Wesley). Since retirement, I have had more time to compose music (almost dropped out of MIT to do that in '58), but for some unaccountable reason I get opportunities to do a bit of product development consulting as well, which I thoroughly enjoy. Drop me a line at <loucohen@cris.com>."

That's it for now. I continue to ask, and implore you to actually do it—send an update, which will be most appreciated by your classmates. Hope to hear from you soon.—**Dave Packer**, secretary, 31 The Great Rd., Bedford, MA 01730; tel: (617) 275-4056 (h), (617) 441-7766 (w); e-mail: <70421.1766@compuserve.com>

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Correction: A photo of Dick Oeler and the announcement of his new position as VP of energy and materials at Air Products in Allentown, Pa., was included with the '61

Notes in the May/June issue. Dick is a close friend of your secretary and a valued member of '60, so we here mention his promotion in the proper class column. Richard will be in charge of a billion dollars worth of materials and energy.—*ed.*

This is a sparse news month—please help your poor secretary! . . . My reliable West Coast stringer reports that **David Aaker** won the *California Management Review's* Eighth Annual Pacific Telesis award for Volume 36 for his article, "Building a Brand: The Saturn Story." David is the J. Gary Shansley Professor of Marketing Strategy at Berkeley's Haas School of Business. David also has written 10 books and numerous articles.

Together with other board members of the MIT Club of Washington, Marie and I recently were privileged to attend the Lemelson-MIT Prize award ceremony at the Smithsonian Institution. It truly was an inspirational evening—and one that made me feel more than a little inadequate. The \$500,000 prize went to Herbert Boyer and Stanley Cohen, the founders of biotechnology. A lifetime achievement award was given to Wilson Greatbatch, holder of more than 150 patents including that for the first implantable pacemaker and who, at age 76, just keeps on inventing. The keynote address for the evening was given by 1960's own **Sheila Widnall**, Secretary of the Air Force.

Unless I receive some news items soon, the next column will feature a travelogue of my vacation trip—beginning tomorrow—that will take us to Poland, Hungary, the Czech Republic, and Austria. And that could be as boring as an evening of watching your neighbors home videos.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204; e-mail: <ftapparo@lmi.org> or <ftapparo@aol.com>

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An e-mail from **John Savage**: "I would like to share with my classmates my pleasure on being reappointed to the MIT Corporation Visiting Committee for the Department of Electrical

Engineering and Computer Science. As we all know, MIT is a great institution, populated with very talented students and faculty. Thus it is all the more interesting to observe how they are adjusting to a rapidly changing world. It is an honor to be invited to offer observations on the department. My stay at MIT lasted for seven and a half years. On leaving MIT in 1965 I joined Bell Labs where I stayed two and a half years before joining the Brown University faculty. Today I'm a member of the Department of Computer Science. Last week I was elevated to Fellow of the ACM. I became a Fellow of the IEEE in 1992."

If you ever need a friend in Singapore check out **Joe Lestyk** at (65) 733-2522. He got there in a roundabout way. Over the years, he has been working as a general council in A. Ahlstrom, a monster Helsinki-based multinational that has been around for 145 years. The part Joe worked for was a power generation subsidiary (they made boilers). The parent decided to jettison the subsidiary and gave Joe the job of negotiating the deal with Foster Wheeler Corp. Sort of presiding over your own funeral. Ahlstrom said they wouldn't sell Joe and promised him a plum position elsewhere. Elsewhere was not defined but could have been some pretty undesirable places. The sale went through last September and Joe waited to learn his fate. It turns out to be Singapore where he moves up to become a director and general council of Ahlstrom's Singapore subsidiary. He will be responsible for all of Pacific Asia. It sounds very exciting. Congratulations! Joe included an Ahlstrom press release in his letter. Part of it is in Finnish. Wow, is that an inscrutable language! For instance, "Nimitys Lakiasianostolla" means "Appointment in Legal Department!"

Another e-mail is from **Pete Bankson** (via **Joe Harrington**). "The word is in on Bankson participation at the 35th Reunion: no. It was tough, but I've been asked by the eldest son of some 25 year friends to officiate at his wedding. In addition, I will be representing Cities In Schools at a White House summit on ethics, sponsored by Amatai Etzioni and his Communitarian Network. So, while you and the rest of my classmates are reveling in memories of great hacks and promises of greater technology, I'll be splitting my time between two jobs, helping prepare kids for successful futures, and blessing the future of a couple of young adults who have been longtime friends."

Bennett Zarren writes to correct a previous column: "My name is spelled with two t's and two r's. My grandsons name is Matan (gift in Hebrew). Just for the record and your benefit! . . . **Craig Tedmon** writes that he is still living in Switzerland and working for ABB as an executive VP in their Technology Group. It's been six years since the Tedmons arrived, and they still like living in Europe. They bought a house in Idaho recently with the

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Peter J. Gordon, '90
Helen Greer, PhD, '74
James M. Hanifin, Jr.
Peter C. Lando
Timothy J. Oyer, PhD '91
Jennifer Paine
E. Robin Plumer
Randy J. Pritzker
Christopher S. Schultz
Paul D. Sorkin
Thomas M. Sullivan
Douglas R. Wolf

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thought of retirement beginning to enter their thoughts. . . . Roger Luchetta sent a postcard of the lovely Johnston Atoll where the government is trying to get rid of chemical weapons. . . . Andrew Willner says that he "dropped out" five years ago after 27 years working as a plastics engineer in basic research and consulting on sporting goods and medical products. Now he is teaching skiing at Vail! Is everyone jealous?

Jim Kee writes that he is an English teacher at Nagasaki Wesleyan Junior College. It's part of an exchange program with the University of Tennessee. . . . Alan Brennecke writes, "After spending five years with Resolution Trust Co., I am taking advantage of its December 31, 1995, sunset date to change careers. Having earned my certification as a financial planner (CFP) a couple of years ago, I'll now put these skills to use in a joint practice with my wife who is also a CFP. I am looking forward to a totally new lifestyle (working for myself). Only time will tell!" . . . Ed Hessler just retired as VP and general manager of Upjohn's chemical division. Now he keeps busy bicycling (3,000 miles in 1995!), running, and computer tracking the stock market. Any hints, Ed?

John "Tex" Ritter has been at three of his kid's weddings over the last couple of years. The fourth and final child graduated from UMass in May. There are some grandchildren. His wife, Barbara, also graduated from UMass in May and is starting a second career. John is still enjoying teaching at UMass and, remarkably, can get funding for his research. . . . Last year Robert Katz retired from the Watertown, Mass., Arsenal after 35 years. The lab moved to Maryland and he decided to stay put. Now he is back at MIT as the Norton Research Professor in mechanical engineering and its materials science and engineering program. . . . Finally, Fred Schmidt sent a card with a magnificent picture of downtown Detroit. He is retired and takes on various interesting consulting jobs. Detroit was the site of an eight-week project on border-control surveillance equipment. He was then off to San Diego where the immigration problems are considerably more challenging.—Andrew Braun, secretary, 464 Heath St., Chestnut Hill, MA 02167; e-mail: <andrewb820@aol.com>

62 35th Reunion

R. Brian Strong dropped us a note that he is happily retired and sailing the world with his wife, Nancy, on board their Doug Peterson 44 Cutter Louise. Brian can be contacted via e-mail at <bstrong@nai.net>. . . . Steven J. Brams visited the University of Alabama in April and gave some talks on his new book, *Fair Division: From Cake-Cutting to Dispute Resolution*, co-written with Alan D. Taylor. Steve's book presents a mathematical protocol that was selected by the *Encyclopaedia Britannica* (in the Britannica Book of the Year for 1996) as one of the top mathematical discoveries of this year. Steve inquired about our forthcoming 35th Reunion—fast approaching in June, 1997—we should all be hearing more about this since the committee will soon be formed and plans assembled.

Alan Kotok is still at Digital Equipment, doing strategy for their new Internet Software

Business Unit. He has been the technical director for that group for the past two years. Alan attended an open house for the MIT Model Railroad Club. Members at the open house spanned the 50-year history of the Club and included our classmates Chuck Niessen and Irv Thoma. . . . John Stanley dropped Ed an e-mail message, (which he forwarded to me), concerning "exit" strategies on his plans to retire. John indicates that he is just going to "peter out" as he gets older, doing less travel and hoping that in a few years improved communications will make a lot of travel unnecessary. Already about half of John's consulting with stations is done from home via computer. He is scheduled to install a 100-KW transmitter in Lebanon, but is just as happy to be here in the U.S. at the moment with the recent flaring up of hostilities in that part of the world. . . . Vic Caravito announces his retirement from The Goodyear Tire and Rubber Co. after 34 years of service. Vic now joins the ranks of the "leisure class," at least for a few weeks. Over the years, Vic has managed knowledge systems, product design and analysis, information technology, and the computer departments for Goodyear. Since he's on top of the technology push, Vic's wife is betting that there's no way he'll settle into retirement at 56. He interviewed seven prospective students for MIT as a member of the MIT Educational Council and was surprised that none were admitted. He notes that the Akron area gets about 25 to 30 prospectives each year and normally about five to seven are good bets. I might add that my experience as the regional coordinator for the MIT Educational Council for the central Alabama area is very similar to Vic's. This was a lean year for us as well with only one admission. My contacts at MIT told me that applications for admission were up this year, and the selection process was significantly tougher than in the past few years.

One sad note, we lost Emerson B. Griswold on January 20, 1996. Griz's brother Tom, '68, reports that his death resulted from injuries sustained in an automobile accident on January 12. After graduation from the 'Tute, Griz worked in the Boston area for professors Keenan and Keyes developing computer generated steam tables, and for various firms including I-Labs and Digital Equipment. He even had a hand in the development of software for the Patriot anti-missile system. Griz moved back to Janesville, Wis., in 1984 to care for his parents in their declining years.

A final note, I was inducted into the Sovereign Military Order of the Temple of Jerusalem (Knights Templar), at the Vernal Convent of the Priory of St. Andrew in Sewanee, Tenn., on April 27, 1996. As a new "chevalier," I now need the use of a horse (history says I can share one with another knight), and some fair maidens to save, dragons to slay, or Saracens to drive from the Holy Land. On second thought, perhaps I could just stay here in the U.S. and keep writing this column as one of my good deeds! We had a flurry of messages concerning the establishment of a class of 1962 e-mail site on the WWW. I am pleased that Ed Feustel has stepped forward to take the organizing role on this—contact Ed at <efeustel@ida.org> or me at <hmccarl@mail.business.uab.edu> with your ideas and any assistance you can offer. We'll

let you know when things are far enough along for you to surf the Web to the MIT Class of 1962 site. If you have access to the Internet, please put a message through to: <mit1962@mitvma.mit.edu> and you can get the unedited and unexpurgated class news while it is still fresh, or fax it to: (205) 934-1318. But even if you still communicate by traditional methods, please send your news and personal notes, via the USPS to: **Hank McCarl**, secretary, P. O. Box 352 Birmingham, AL 35201-0352.

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Please send news for this column to: **Shoel M. Cohen**, secretary, Dept. of Psychology, Nassau Community College, Garden City, NY 11530; tel: (516) 489-6465 (h);

e-mail: <71271.2627@compuserve.com>

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The Class of 1964 Student Aid Fund is supporting **Laura Mobisson**, a senior from Norwood, Mass., for the 1995-96 academic year. Laura, who is majoring in mechanical engineering, is a member of the National Society of Black Engineers and the African Students Association. In addition, she serves in the outreach program of the AIDS Action Committee and sings with the MIT Gospel Choir. Last summer, Laura worked as an engineering intern for Merck & Co., Inc. She has applied to medical school for next year. The continued generosity of our alumni/ae allows the Institute to sustain its commitment to fine students such as Laura.

John Reed (Course XIV) will be spending 1996-97 at Cambridge University as the Pitt Professor of American History and Institutions. With his wife, Dale, he has written a new book *1001 Things Everyone Should Know About the South* (Doubleday). . . . **Bruce Knobe** (Course XVIII) is providing technical support to the sales force at Sequent Computer Systems. His wife, Kath, is about to finish a PhD in computer science at MIT, while son Job is about to graduate from Stanford in philosophy.—**Bill Ribich**, secretary, 18 Revere St., Lexington, MA 02173; tel: (617) 862-3617; e-mail: <mit1964@mitvma.mit.edu>

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Class heroes of the month are **David Rubin**, **Richard McMillen**, and **Ron Mandle**, who took advantage of Internet to send me their latest updates. I would encourage

you all to do so.

David reports that he and his wife, Sharon, moved to New Jersey two years ago when she was offered a major position at Ramapo College. David left COMSIS and joined ICF Kaiser. He reports that his work includes everything from the Calcutta trams to the Miami airport. His older son, Ari, was to be married this summer, and his younger son, Josh, just graduated from the University of Chicago.

Speaking of Chicago, Richard is looking for the whereabouts of L.Q. "Larry" Lambert, a roommate who disappeared after they were at the University of Chicago together. If any of

you have recent contact information for Larry, please let me know.

Ron had an exciting update on **Bill Brody**, who has been named president of Johns Hopkins University. Bill had been at the University of Minnesota most recently. . . . The *Wall Street Journal* reports that **Dick Ayers** will step down as chairman and CEO of the Stanley Works next year.

Dean Athans was recognized by the American Society for Engineering Education for his outstanding work in community college education at East Los Angeles College. Dean has been at East Los Angeles since the late 1960s.

Write, or more appropriately in this modern age, e-mail me with your own updates.—

George McKinney, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167; tel: (617) 232-4710; e-mail: <georgemck@aol.com>

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I got only one letter this month: from **Howard Cohen**, but not about Howard.

Instead, he detailed the activities of six of our classmates from Hong Kong, who, in

1991, formed the Hong Kong MIT Club '66.

As a group they provide an annual gift to MIT, to be used for grants to undergraduate students of Chinese origin from Hong Kong, China, Taiwan, or Singapore. Howard's business travels take him to Asia several times a year. Earlier this year he met **Arthur Kwok**, managing director of the

architectural and design firm of Arthur C.S. Kwok Architects and Associates. If you have been to Hong Kong you have probably seen buildings designed by Arthur. As senior superintendent of the Police Auxiliary, Arthur is one of the Honorary Aides de Camp at Government House (that means, to the governor of Hong Kong). When the Queen of England visited Hong Kong, the man in dress formal in back of the Queen was Arthur! . . . If you have seen Wanchai, Hong Kong, progressively expand into the "fragrant" harbor, get some facts from the Shui On Group Ltd., beneath which are a myriad of property companies run by **Richard Ho**. . . . The international edition of *Business Week* recently listed **Victor Fung** among "The 25 Top Managers of the Year." In addition to managing Li & Fung Ltd., an export-trading business, Victor is chairman and CEO of Prudential Asia and the smiling face on all the literature from Hong Kong export associations. . . . After years in the U.S. managing investments, **Laurence Liu** is now a bank officer in Hong Kong as Hong Kong prepares for its return to China. . . . **Daniel Pang** is one of the lead people for Sun Hung Kai

ClassNotes

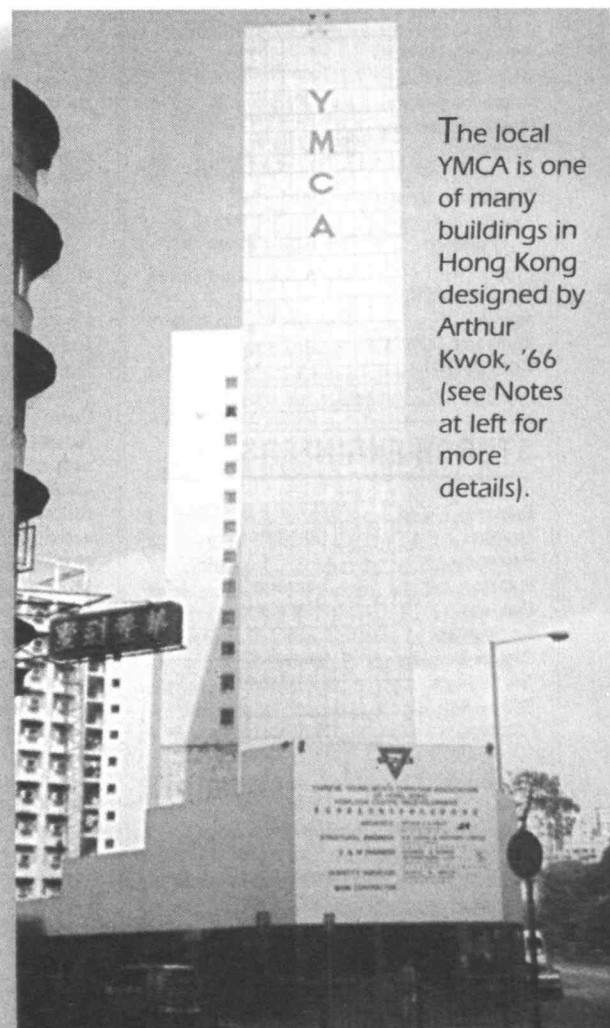
Properties in China, a major company in property development in Southeast Asia. . . . After three years as a professor of civil engineering at U/Illinois-Urbana, **Wilson Tang** returned to Hong Kong. Now, the engineering department at The Hong Kong University of Science and Technology competes directly with MIT for Hong Kong's best and brightest.—**Eleanore Klepser**, secretary, 84 Northledge Dr, Snyder NY 14226-4056; tel: (716) 839-3525; e-mail: <vismit66@ubvms.cc.buffalo.edu>

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30th Reunion

I was saddened to learn that **Joel Spears** passed away suddenly in April due to an

aneurysm. He was a department manager in Raytheon's Mechanical Design Lab and worked with **John Rudy** and **Bob Ferrara** for many years. Joel and Mary lived in Lexington, Mass.—**Sharlotte** and **Jim Swanson**, co-secretaries, 878 Hoffman Terrace, Los Altos, CA 94024; e-mail: <jswanson@lat.com>



The local Y.M.C.A. is one of many buildings in Hong Kong designed by **Arthur Kwok**, '66 (see Notes at left for more details).

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In order to encourage use of e-mail (which should lower the threshold for sending in news and thus make our job easier), we will start with items we received electronically. Rick

Borken <71544.1556@compuserve.com> reports, "I've been a faithful reader of your Class Notes, and . . . I've finally got an item which I think is newsworthy. The Honeywell Corp. recently named me a vice-president—I am VP of project management at Honeywell, Defense Avionics Systems in Albuquerque, N. Mex. My wife, Liz, and I moved to the high desert two and half years ago after spending 16 years in Minneapolis, where I held management positions in research and engineering for Honeywell. Our daughter, Sara, stayed in the frozen north, where she is a junior at the University of Minnesota." . . . From far off Yellowstone, Northwest Territories, Charlotte Babicki <babicki@gov.nt.ca> reports, "The only news I can think of is that I still have a job so far." ("Rightsizing" is a big issue in the Canadian civil service now.) Charlotte recently finished a wedding quilt for Sandra Harris, '69, just in time for her 20th anniversary. You may recall that in the 25th Reunion yearbook there is a picture of one of 29 baby quilts Charlotte has made for relatives and friends.

Snail mail also works! Robert Levasseur has published a book entitled, *Breakthrough Business Meetings*. He writes that it is "available in any bookstore and is doing well so far." . . . An insightful observation came from Jim Heide, comparing his son's college era and ours: "As I picked up my son at the end of his junior year at Haverford College, I was thankful that his concerns about senior year research, grad schools, or jobs were not overshadowed by a draft and a war—something I had to deal with 30 years ago when I should have graduated." Jim interviews applicants to MIT for the Educational Council.

Next, medical news items: David Swedlow is "still" VP of medical affairs and technology for Nellcor-Puritan Bennett. . . . Stanley Chang has been appointed the Harkness Professor of Ophthalmology and chairman of the Department of Ophthalmology, Columbia-Presbyterian Medical Center in New York. . . . From Poughkeepsie, Ron Rosen reports that Rosen Associates was awarded a small business innovation research grant by the National Cancer Institute to develop software for the followup and tracking of cancer screening activities. They have also hired their first two employees to keep up with the new work. . . . In Pittsburgh, where Elaine and Andy Gurcak have spent their whole lives apart from out-of-town education, Andy is now manager of advanced product development at Loral Defense Systems, where one of his products is a sinus surgery simulator. He would like to hear from any Burton alums who get trapped in a long USAir layover in PGH.

Back in Beantown, Ken Theriault has had one of those "overlap years" with two children in college. Seth is a senior at Washington University in St. Louis, now led by Mark Wrighton, and Emily is a freshman at Lafayette College in Easton, Pa. Ken's acoustics/ASW work at BBN is continuing despite the defense budget, but he also expects to be working in the networking area soon. . . . Finally, Paul Forbes sends a long letter from far away: "Greetings from Indonesia. I am

helping build new power plants, both gas turbine and geothermal." Paul has worked for Bechtel for the past 17 years. "When I grow up, I probably will want to build things because I have worked in construction since graduation, mostly new power plants of various types. I spent four years in the Navy Seabees, including the obligatory time in Vietnam. Worked in Africa for a while after a grand tour of Europe in the 1970s. Got married and raised three boys. . . . There's so much in life to enjoy, so many places to see and experience, and so little time to do it all. By the way, Indonesia is a beautiful country and the Indonesians are friendly, interesting, and insatiably curious. It's a pleasure to be here."

Mike was elected to the Alumni/ae Association's National Selection Committee in the spring election and wants to thank you all for your support.—Gail <ghm@nrc.gov> and Mike Marcus <mrmarcus@fcc.gov>, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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When you read these notes, we will have moved to our third house in Bow, N.H., so I thought it best to give you a stationary mailing address—our post office box in neigh-

boring Concord. We'll be seven miles closer to Concord and will have no more of that dead-end, unpaved country road that has helped to make the local Midas dealership rich off our 250,000-mile Volvo! Incidentally, when we finally trade "COSMOS" in, I plan to get a new vanity plate: "PD+D2O"—what else!

Roger Chang reports that he has been publishing the *Maryland State Wrestling* paper for four years. Son Mike has wrestled for four years in high school. Roger writes, "This year his old team won the state dual championship. Our old interests in athletics seem to surface even after a 25-year latency! I even host the East Coast Club Championship and an Eastern Nationals Wrestling Qualifier. Wrestling and other sports develop a sense of teamwork and self-esteem that builds character and is as much a part of education as calculus and physics." . . . Another athletic matter: Herb Lison of Newtonville, Mass., is trying to get in touch with other '69 class members or others who rowed on any of the crew teams coached by Dennis Buss. He can be reached at <herb.lison@fmr.com>, or by telephone at (617) 563-5068 or fax: (617) 476-9441. . . .

Gary B. Hirsch continues to work as a health care consultant, specializing in the development of management simulations to help people deal with the rapid change occurring in health care. His wife, Linda, is a photographer/photojournalist. Older son Adam has just begun a doctoral program in earth systems science at UC/Irvine. Gary writes, "We had a great road trip together, driving his '85 Volvo wagon out there in December 1995." Younger son Dan is a senior in high school and is busy applying to college, running conferences, and appearing in drama productions.

John R. Smith writes from Palos Verdes Estates, Calif.: "Still retired and playing lots of tennis in beautiful Southern California. Went to the U.S. Open in September—great front row seats and great tennis! Spent a month traveling around Australia and New Zealand

and had a fantastic time. Especially enjoyed Sydney, the Great Barrier Reef, Ayers Rock and Kakadu (The Outback). My wife, Dr. Vivien Dee, and I just celebrated our 11th anniversary. We find life very challenging, but also very rewarding."

Carol Scott-Conner, MD, writes of a notable achievement: "Effective October 1, 1995, I became the new head of the department of surgery at the University of Iowa College of Medicine. This past year has been a busy one for both of us, as I finished work toward an MBA at the Elsie School of Management, Millsaps College. This busy year culminated in the excitement of going through the search committee process culminating in my current appointment. Harry and I are recovering from the move and have started to settle into our new home in Iowa City and are awaiting the start of the Midwest winter with some trepidation. The department of surgery at University of Iowa, composed of three divisions—general surgery, neurosurgery, and cardiothoracic surgery—and has 50 faculty members and approximately 150 additional support staff and residents. UIHC is the largest University Hospital in the country and was recently featured in the popular press as one of the 'Best Hospitals in the U.S.' I will continue to be clinically active as a general surgeon, and carry the academic rank of full professor in the division of general surgery."

The end of October 1995 found Chris Brooks and Eugene Thorner, '70, continuing their 29-year friendship (just a few years less for their wives, Christine and Barbara, too) in Paris and Grenoble, to celebrate the wedding of Chris and Barb's elder daughter Kristin Brooks to Kenneth Scott Toussaint on October 28. Chris writes, "Many adventures were packed into several days, including a private winery tour and tasting, a trip to the cliffs of the Chartreuse mountains 5,000 feet above Grenoble, and of course the wedding and reception. Kristin is in her final year at the University of South Carolina, in a joint master's in international business and JD program. Her husband, Scott, is a practicing attorney in Spartanburg, S.C. They decided to marry in France during Kristin's internship in the corporate legal office of Michelin."

We have been informed by the MIT Alumni/ae Association Class Giving Program manager that the funds available in the Class of 1969 Paul E. Gray Scholarship Fund have significantly increased since last year, and two students have been selected to receive the award for 1995/96. Alula Abera, who had the award last year, has been renewed for his senior year, while Ginger Green, a junior biology major from Anaheim, Calif., is receiving the award for the first time.

I'm proud to report that *Infinite Energy* magazine made it through six issues of Volume 1 and is now accelerating through these exciting, revolutionary times. Transmutations have now been confirmed in both Ni and Pd excess energy systems, both in the U.S. and in Japan. Motorola and several university researchers have confirmed the substantial non-chemical excess energy in the Patterson Power Cell. Science journalist Ron Dagani, PhD '75, wrote about us in a full-page opinion piece in the American Chemical Society's *Chemical and Engineering News* (April 29, 1996—yes, on page 69), "Cold fusion lives—sort of." Indeed!—**Eugene F. Mallove**, secre-

tary, P.O. Box 2816, Concord, NH 03302-2816; e-mail: <76570.2270@compuserve.com>

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Tim Gilmore continues to work for Group Health of Puget Sound, is still married, and trying to keep up with his kids. He sets a pretty fast pace himself—he qualified for the "nationals" in master's swimming and beat **John Stempeck** and **Bob Ferrera**, '68, in racquetball at our 25th Reunion last year.

Speaking of the reunion, the Class of 1970 Jerome B. Wiesner Scholarship Fund that we established at that time has given its first award. It went to Susan Park, '98, a chemical engineering major who is investigating the geometry of pig liver lobules. She is a violinist who plays in several groups, including the Chamber Music Society, and is a member of the women's novice crew team. Please think about making contributions to this fund so we can give out more grants!

Karen has finished her year as president of the MIT Alumni/ae Association and is now turning her attention to higher education for *The New York Times*. She has written about the sharp rise in early decision applications to colleges, the decision by the University of Rochester to phase out its graduate math program (later reversed), and the budget woes of the State University of New York and the City University of New York university systems. It's a great beat!—**Karen and Greg Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023; e-mail: <dghbm13d@prodigy.com>

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Please send news for this column to:
R. Hal Moorman, secretary
P.O. Box 1808
Brenham, TX 77834-1808

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25th Reunion

Please send news for this column to: **Wendy Elaine Erb**, secretary, 6001 Pelican Bay Blvd., #101, Naples, FL 33963

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David Moylan is revising his textbook, *Introduction to Clinical Radiation Oncology*, published by the Medical Physics Publishing Co. This edition, the third, will be available in August. . . . **Kent Sharp** is engineering manager for Viisage Technology, the digital imaging division of Lau Technologies. They are a systems integrator of identification systems, producing drivers licenses and other ID cards, as well as working with facial recognition.

Yours truly has been traveling extensively for PRC (now a division of Litton Industries) this spring, in such swinging metropolises as Dayton, St. Louis, New Orleans, Inyokern, Calif., and Fayetteville, N.C. I always manage an evening with the local barbershop chapter, ensuring that my wife doesn't have to worry

ClassNotes

about which bar I'm in. She is completing her degree after a sufficiently long time that some of the transferred credits were 26 years old! Bless the Virginia university system.

Write or e-mail!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 7721 Churchill Ct., Marshall, VA 22015 (new zip code!); e-mail: <sutton_bob@prc.com>

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Jeffrey Ng is a senior associate at Ehrenkrantz & Eckst Architects, and lives with his wife, Winnie, and two sons Thaddeus (7) and Thomas (4) in Fairfield Conn. . . . After nine years in Sri Lanka as director general of the International Irrigation Management Institute, **Roberto Lenton** has taken an appointment in New York as the director of the Sustainable Energy and Environment Division of the United Nations Development Programme. . . . **Frank Morgan** won an NSF grant for Williams College where he is a professor of mathematics. Frank is conducting research on the geometry of bubbles while striving to understand why things take on specific characteristic shapes. For example, while hexagonal honeycombs occur in beehives and throughout nature, the mathematical properties of such

Puzzle

Continued from Page MIT 55

Better Late Than Never

1995 N/D 2. Harvey Amster sent us some observations on the round-off errors that arise. A copy of Amster's remarks can be obtained from the editors of *Technology Review*.

Other Responders

Responses have also been received from R. Bart, B. Cain, F. Cardin, J. Chandler, W. DeHart, D. Eckhardt, M. Egerton, S. Feldman, R. Ferguson, M. Foster, M. Fountain, W. Hartford, R. Hess, M. Ionescu, J. Landau, E. Levy, L. Nissim, A. Ornstein, D. Pecora, F. Pownser, E. Rapaport, K. Rosato, E. Sard, A. Schuchat, M. Seidel, R. Shapiro, R. Sinclair, and R. Spencer.

Proposer's Solution to Speed Problem

16 ounces in a pound; 90 degrees in a right angle; 1 wheel on a unicycle; 5 digits in a zip code; 11 players on a football team; 1,000 words that a picture is worth (I know, that stretches it); 29 days in February in a leap year; 64 squares on a chessboard; 40 days and nights of the Great Flood.

patterns remain unproven.

Another honor for a classmate was earned by **Jonathan Abrokwa** who was elected to the board of Advocates for the Disabled, an organization that assists Social Security disabled claimants who have been denied benefits, the homeless, and AIDS-infected persons who need assistance when applying for Social Security benefits. His regular job is at Motorola, Inc., in Arizona where he is the manager of the materials group. . . . **John Hixson** is in his seventh year as housing development coordinator for the city of Newton, Mass. Now I can sleep better knowing that a classmate is taking care of housing in my hometown. He lives in North Cambridge with his wife and two children, Elizabeth (11) and Joseph (9), but when you read this they will be at a family camp in the Adirondacks.—**Barry N. Nelson**, secretary, 65 Hillside Ave., Newton, MA 02165; e-mail: <barryn@world.std.com>

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Matt Farber <vtrealman@aol.com> reports: "I have just incorporated as Allen County Retinal Surgeons PC, located in Fort Wayne, Ind., and have taken on a partner, so I shall

no longer be on call every night! Now I may get to see my son Aaron, 10, and daughters Eve, 4, and Karimiya, 2, awake. Planning to visit Paris this summer. Look forward to hearing from other members of AEPI.

That's all for this column. Let's have some more news, please.—**Jennifer Gordon**, secretary, c/o Pennie & Edmonds, 1155 Avenue of the Americas, New York, NY 10036; e-mail: <gordonj@pennie.com>

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If you have not provided your e-mail address for our class e-mail list, please do so. Among the benefits are receiving the Notes shortly after they are submitted to the

Review, rather than months later when they appear in print, and an e-mail directory of the classmates on the list.

From **Dianne Glennon**: "Married January 11, 1991, Richard Khuzami. Formerly with Citibank International, Miami, after Sloan School graduation in May 1985, followed by Citicorp Real Estate Miami and New York. Currently with Dime Savings Bank, New York, financing real estate and construction of low-income housing (198-unit tower at edge of Chinatown to be completed in 1997)." . . . **David Leighton**, after 14.5 years at Gencorp Aerojet in Southern California: "I've moved to Lockheed Martin Missiles & Space in Silicon Valley. Before leaving Aerojet, my team leader and I received the 1995 R. B. Young Award for Technical Innovation at Aerojet for our work on the Visual Expert Diagnostic System. I am working as a software specialist at the CRSS commercial imaging satellite program at LMMS." . . . **Jordan Wouk** is coordinating the Year 2000 effort for Merck-Medco Managed Care. (*Secretary's Note*: This is an example of a software project to convert legacy software systems to cope with the year 2000 as an acceptable date.)

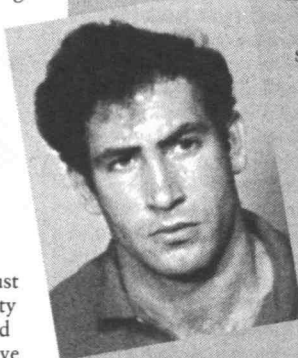
Marie Woodall Patureau, working for AXA Insurance in France (formerly Drouot Assurances), recently had the occasion to meet with

colleagues from New York, AXA Canada, as well as Japan and other countries. She is head of the budget/audit and accounting departments for AXA Insurance in the Ile-de-France Regions. Marie and her husband, Jean Pierre (ScD '76), are the parents of Fred (14), Stephanie (11), and Emeline (7). . . . **Michael A. Lee** writes, "Mei-Gee and I and our two boys, Mike (12) and Andrew (9), are enjoying life in California. I'm a cardiac electrophysiologist in East Bay (San Francisco area). My MIT training continues to help me daily in dealing with the electrical problems of the heart!" . . . After almost 20 years, word from **Todd Harlan-White**: "Back during sophomore year, I joined the cooperative program in Course XIII (naval architecture and marine engineering, a.k.a. drawing pictures of boats for a living), spent most of my work periods with Westinghouse Oceanic in Annapolis, and ended up with a combined SB/SM a year after most of you in 1977. But I am still considered part of the Class of 1976. Well, I'm still here at Annapolis with the same group (although

Westinghouse sold us last year to Northrop Grumman to pay for buying CBS). I've been working all this time as a naval architect, concentrating on small submarines manned and unmanned, with the current one being a remote mine-hunting sub controlled by operators aboard a distant mother sub via a many-mile-long fiber-optic cable. Like many of you (I assume), I've gone back to school and gotten a management degree to help deal with mobilizing people towards a common goal—in other words, to better know when I'm being lied to. I got married while a co-op student in Annapolis, changing my name from White to Harlan-White. (Hey, it was a cheap wedding present, and it moved me up 17 letters in the alphabet!) The hyphenated name has been a continual source of confusion over the years, making it hard for people to find us. Faith is assistant dean at the local community college, and our son, Paul (7), keeps us both very busy. We got our first boat 10 days after moving to Maryland, and now sail around on boat #4, a cruising catamaran, in between soccer and

Israel's new prime minister

—its youngest prime minister and the first to be elected directly by the Israeli people—is an MIT alumnus. Benjamin Netanyahu, then known as Benjamin Nitay, received a bachelor's degree in architecture from MIT in February 1975 and an SM in management in May 1976.



Netanyahu, the son of a Cornell University professor, spent most of his teenage years in the United States. He returned to Israel for army duty and was 23 by the time he arrived at MIT. He so impressed Professor Emeritus Leon Groisser of the Department of Architecture at their first meeting that the latter allowed him to take a double course load. His continued overloading and excellent performance enabled him to complete a bachelor's degree in two and a half years, and he went right into graduate studies.

When he left the Institute abruptly in June 1976 (following the death of his older brother, Yonatan, in the raid to free passengers held hostage at Entebbe Airport in Uganda), Netanyahu had completed the management degree, started a thesis for a master's degree in architecture, and been admitted to the doctoral program in political science.

Author Conor Cruise O'Brien, having spent years observing Netanyahu as his country's permanent representative to the United Nations, wrote in the *New York Times* that he has the "potential to be the ablest Israeli prime minister since David Ben-Gurion." The MIT community, along with the rest of the world, can hope O'Brien is right. ☆

Above, Netanyahu during his MIT student days; at right, with former Israeli Prime Minister Yitzhak Shamir at the 1991 Middle East peace conference held in Madrid.



lacrosse games, karate lessons, and Cub Scouts. I still keep up with my singing and perform at the local Renaissance festival every summer, or at the drop of a hat other seasons. Ever since graduation, I have been a member of the Educational Council, interviewing MIT applicants—some years just a few, some years over a dozen. (To volunteer, contact the Council at MIT.) Since my family comes from and still lives near Boston, I visit the campus every now and then to keep up on what's going on and how the students I have interviewed are doing; in general, there have been very few noticeable changes over the last 20 years. I do recommend taking a tour and seeing the new admissions video sometime: *MIT A Great Place to Party*. It was a major and difficult-to-handle milestone when the applicants I interview started being born after my MIT graduation."

E-mail news: **Peter Hobbs** (originally '74) and **Pearl Huang**, '80 (originally '78), "I'm sitting here almost fully recovered from the '96 Boston Marathon, 8,528th with a net time of under 3:25, writing this because it now seems unlikely that we will be able to attend the reunion this year. Pearl and I drove to Boston for the marathon from Lansdale, Pa., with our three children—Helen (8), Emmet (6), and Max (11 months). We went to the 'Tute to see the Student Center and have breakfast at Lobdel so the kids could see where mommy and daddy met. Then over to Strobe Alley to play with the displays. Helen got a kick out of making the droplets stand still, and Max loved climbing the steps and walking in the hallways, but Emmet just wanted to find out how to get up onto the top of the dome (must be in the genes). I'm still working at Air Products in Allentown (since MIT PhD in '85) doing surface fluorination, but in the last five years the amount of travel has increased enormously. The work has little to do with anything I took as an undergrad or grad student. But by keeping at it over these last 11 years, and by not losing any vital organs or appendages, I've managed to become something of an expert in the field. One of the major applications is the fluorination of plastic automotive fuel tanks to reduce hydrocarbon emissions, thereby allowing vehicles to meet the California Air Resources Board (CARB) and EPA mandate emission standards. In fact during the reunion I'm likely to be either in Cardiff, Wales, doing the startup of a greenfield facility to use our new fluorination technology, or Brussels. Pearl's work has started to involve some travel, too. She is still doing microbiology (cancer research) at Merck in North Wales (since Princeton PhD in '90), but now she is invited to conferences and gets to be keynote speaker. I don't know how other two-career couples manage out there, but we seem to always be strained to the limit. It is hard to keep the family first. We talk about changing jobs to cut down the away time in particular, but it is hard to find locations where both of us can be fully employed. We don't seem run into many MIT types, except for Pearl's sister Priscilla, '86, and her husband John Singer. (They have a new baby, Emma). We are located in Lansdale about halfway between the MIT Philly club and the Lehigh Valley club. Just up the road from us are Gene Tung and his wife, Lisa (Vingerhoet), both class of '88. I met Gene while running at work; he did Boston in under 2:51 so perhaps I should say I saw him from a great distance behind."

Peter Kaufman writes, "My wife, Marie Lurquin, and I have a 7-year-old son, Benjamin, now in first grade. Having left academic medicine six and a half years ago for private practice in Bethesda, Md. (and Rockville, Md.), I've become engrossed in computer applications in medicine and maintain my practice entirely on computer, including hospital records that I print on the chart using a notebook computer and a portable printer. I'm ready to make the jump to purely paperless soon, which will involve digitizing lab reports and letters received. I'm preparing a marketable (hopefully) version of my software, beta versions of which should be available by this summer." . . . **Steve Isaacs** writes: "I have a higher title, forsknings-lektur instead of forsknings-adjunct, which only means more status and slightly more pay (very slightly since my taxes take up 60-plus percent of any additional kroner that I earn). Translated to English, the title is actually associate professor, but this is misleading, since I do not have any lectures, I do not teach, and my position is funded by my project, i.e. temporary and ends when there are no more project funds. At the moment I am supervising some "last year" students who perform five-month thesis projects similar to MIT's SB thesis requirement. Only here you are considered to have an SM after doing this (there are five rather than four years here in the basic study). I also have two German PhD students. I am open to any of my former colleagues questions (e.g. about life in Denmark or working abroad) and to anyone in the area stopping by. I can be reached via e-mail at <si@kt.dtu.dk> or by phone at work: (+45) 45 88 32 88 and ask for me. Or by mail at the Department of Chemical Engineering, DTU-229, DK 2800 Lyngby, Denmark (that little country next to Sweden)."

As for your secretary, he continues to plug away on a variety of business fronts, eking a living from the hard, stony earth. Due to scheduling conflicts, I will unfortunately not be able to attend the entire reunion. I hope to be able to fly in for one day, Thursday, conditions permitting. However, I would like to go on record to ask you to re-elect me as class secretary for another term of office. I still enjoy being the secretary very much, and the advent of e-mail and the class list have made the position, in some respects, easier.—**Arthur J. Carp**, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523; tel: (516) 295-3632; fax: (516) 295-3230; e-mail: <quantalyt@aol.com>

77 20th Reunion

Please send news for this column to: **Ninamarie Maragioglio**, secretary, 9727 Stipp St., Burke, VA 22105

78 **Paul Martin** brings us up to date with a letter from Liverpool, N.Y.: "After finishing graduate school, I joined GE, which had just purchased RCA. Martin Marietta bought GE Aerospace, and then merged with Lockheed to form Lockheed Martin. Yesterday, the acquisition of Loral closed. After ten years of

ClassNotes

this—working for three different companies—I finally get a new office. The microwave business is being consolidated to Sanders (a Lockheed Martin company) in Nashua, N.H., and I will be there in September. If you are ever in that neck of the woods, look me up at whatever-the-name-will-be-by-then. My job description has changed almost as often as my employer, but I am still married to Beverly Leesman, with a 5-year-old daughter and a son on the way."

Lawyer Mitchell Novick married Gail Moskowitz, '79, in Passaic, N.J., in March. Mitchell received his law degree from Rutgers University. Gail is an immuno-hematologist and is the blood bank director at the VA Medical Center in the Bronx. Congratulations to the newlyweds! . . . **Dan Halbert** sent a note with his Alumni/ae Fund donation: "I have been working at BBN Corp. in Cambridge since May '95. I worked there as a student 20 years ago and am pleased to be back. Currently, I'm working on a project that delivers personalized newspapers via the Internet. I live in Newton with my wife, Carole Slipowitz, and a 3-year-old daughter, Emma Halwitz." . . . **Bill Kuttner** also sent news with his donation: "I am currently working on the North-South Rail Link and New Urban Ring long-range transportation projects in metropolitan Boston." Bill lives in Charlestown, Mass.

We also have news of three fine students who received funding during the past school year through the Class of 1978 Student Aid Fund. Your donations to the fund *do* make a difference!

Luong Tran, a senior, will complete a double major in materials science and engineering plus electrical engineering and computer science. Last summer Luong worked for UC/San Diego's EECS department doing vision research. Luon has been doing UROP work with molecular computation.

Joseph Lee, a junior from Warminster, Pa., has chosen chemistry as his major and is planning to attend medical school. Joseph has been doing UROP for a joint Dana Farber Cancer Institute/Harvard Medical School project. He is a member of the crew team and tennis team, a volunteer tutor at Boston Latin High School, an interpreter for Brigham and Women's Hospital, an a cappella singer, a martial arts instructor, and an officer at Sigma Chi Fraternity.

Miguel Ochoa is a junior from Pacoima, Calif. Miguel is majoring in mechanical engineering and plans to go into industry. Last summer, he interned with Litton in California. He plays intramural hockey and soccer, and is an officer of LUCHA (La Union Chicana por Aztlan) and a member of the Society of Hispanic Engineers.

Meanwhile, your class secretary and wife **Diane Curtis** are in the midst of the spring "high season" in real estate. We're expecting at least a 50 percent increase in business this year over last year. We're especially enjoying working with clients from nearby Denison and Kenyon universities.—**Jim Bidigare**, secretary, 9095 North St. Rd. NW, Newark, OH 43055-9538; tel: (614) 745-2676; fax: (614) 745-5648

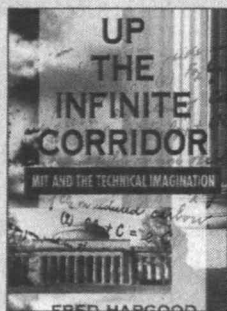
Up the Infinite Corridor

MIT and the Technical Imagination

by Fred Hapgood

This lively, eminently readable account of MIT's engineering research will stir up memories while bringing readers inside some of the current projects happening around the Infinite Corridor. Delving into MIT's rich, sometimes bizarre history, *Up the Infinite Corridor* explores the folkways of undergraduate life, as well as the

unique sense of humor that emerges from the pressures and insecurities of the place where everyone's intellectual accelerator is wired to the floor.



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Please send news for this column to: Sharon Lowenheim, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374; e-mail: <lowens1@pfizer.com>

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Richelle Wolff wrote an update on husband Dave McComas and their family. The family includes three sons: Random Alexander, 8, Koan Isaac, 6, and Orion

Gabriel, 3. They have lived in New Mexico since leaving MIT except for a brief sojourn in Los Angeles, where Dave earned an MS and PhD in geophysics and space physics from UCLA. For the past few years Dave has been the group leader of space and atmospheric sciences at Los Alamos National Laboratory where he designs and builds space hardware and analyzes data. They love living in the beautiful Jemez Mountains and spending time on their recently acquired 30 acres of untouched high mountain meadow and forest. If you would like to get in touch with Richelle or Dave let me know—they would love to hear from you.

Two e-mail notes this month: Marlon Weiss in Fort Dodge, Ia., is following a career path similar to Paul Homsy (see May/June Class Notes). Marlon is doing industrial medicine as an outgrowth of family practice but longs to do more engineering. . . . If you read this column before June 27 make sure you tune into *Jeopardy* on that date to see Brian Clouse! Also, Brian's love of trivia qualifies him to host trivia games twice a week on the Prodigy service—look for him in the chat area or on the trivia bulletin board as "Elvis Lives." His e-mail address is <pszy40b@prodigy.com>.

Brian is a design engineer at GE Aircraft Engines in Lynn, Mass. He and his wife, Martha, have two children, Matt, 11, and Sally, 8.

Linda Jo (Dolny) McTeigue has left General Magic to launch MLM Consulting, a sales and marketing consulting organization. Linda Jo and her husband, Mike, have a 1-year-old daughter, Melinda (Mindy) Jean. . . . Carey Rappaport announced the birth of his second child, first son, Brian Hampton, born February 22, 1996. . . . A news clipping notes that Walter Sargent has opened a law firm and will continue his practice in civil appeals.

Please send your news and postcards for this column to: Kim Zaugg, secretary, 549 Fairfield Rd., Canton, MI 48188; tel: (313) 981-1785; e-mail: <vayda@erim.org>.

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OK, I guess everyone was saving up their news to send in just before the reunion, which is fast approaching as I write. I hope everyone who was there had a good time. I'm sure I did!

Besides the Olympics—from Atlanta we learn that Hans von Spakovsky and wife, Susan Burnell, '84, have added new son Christopher, who arrived last December, to the family, joining sister Elizabeth. Both Hans and Susan have become very involved in the community and civic organizations, and both enjoy living in Atlanta very much. While both Hans and Susan at one point were practicing law, Susan (a classmate of yours truly at UGeorgia School

of Law) has now become a "full-time mother," while Hans reports that the company where he practices as an in-house counsel has recently experienced financial setbacks, so he "will probably be changing careers even sooner than most of us when they hit the mid-life crisis."

Medalist: Navy Lieutenant Commander Ronald LaSalvia was recently awarded his *third* Navy-Marine Corps Commendation Medal while serving with the attack submarine USS *Boise*, based in Norfolk, Va. Ronald was awarded the medal for his outstanding performance as executive officer on one of the Navy's newest submarines. He traveled more than 20,000 miles with the submarine during its first six-month overseas deployment, operating in the Adriatic Sea near Bosnia and in the Persian Gulf near Iraq, supporting ongoing operations. . . . Also with the Navy, Joe Molitoris is still working at the Center for Naval Analyses as project director. His latest research involves new satellite technologies for military use. Joe runs the Mine Warfare Association with Al Bottoms, SM '62. At home, Joe has two daughters, Hanna (5) and Mary (1).

Well-connected: Howard Marson started a company called Connected Corp., which develops Internet-based on-line data management services for the small office and home office PC market. Howard also reports that wife Martha is still working part-time as a social worker, and that daughters Alix (4) and Jade (1) "are doing great and keeping us laughing."

Neural network: Jim Pekar has joined the faculty of Georgetown University as assistant professor in the Department of Neurology, and as director of the Magnetic Resonance Research Laboratory of the Georgetown Institute for Cognitive and Computational Sciences. Jim also maintains an affiliation with his previous employer, the National Institutes of Health. In his research, Jim uses magnetic resonance imaging to study brain physiology and function. He's glad to hear from classmates on the Net at <pekarj@giccs.georgetown.edu>.

Long course: David Kazdan has taken the hard road to success. After an MD, medical internship, PhD in biomedical engineering, realizing that academic employment and staying in Cleveland weren't compatible, and entering an anesthesiology residency, David reports that he is finally *done*. He recently learned that he passed his board examinations and has no more tests to take, "although law school is looking mighty interesting. . . ." (A word to the wise, David: think again!) David is gainfully employed at Meridia Huron Hospital, a small teaching hospital in East Cleveland. Wife Laura Gooch, '82, is a senior engineer (project manager) at URS Consultants in Cleveland. For fun, David and Laura do a little ham radio (AD8Y), a little photography, and a little R/C airplane flying.

Short reports: William Haskins is currently senior sales account manager for DuPont, focusing on chemical intermediates for lubricants, polyurethanes, and specialty resins. . . . Jose Schutt-Aine is associate professor of electrical and computer engineering at the Ullinois/Urbana Electromagnetics Laboratory, and is doing research on packaging and signal integrity. . . . Thomas Woolfolk has left engineering to become director of community rela-

tions for Therapy Services of Virginia, a physical therapy provider. . . **Rich Valicenti** is now a professor at the Thomas Jefferson hospital in Philadelphia. Rich and wife Robin have a beautiful daughter, Nicolette, and recently took a vacation tour of Italy.

Anitta Bliss reports that she has experienced some ups and downs of late. Last year got off to a great start—Anitta got to manage a new Apple Powerbook computer, and also got engaged. Unfortunately, Anitta's health took a turn for the worse, when she learned that she was suffering from CFIDS (Chronic Fatigue Immune Dysfunction Syndrome). As a result, she hasn't been able to work since last August. Our best wishes go out to Anitta for a speedy recovery.

Have a good summer, everyone. It was fun. Please send news for this column to: **Mike Gerardi**, secretary, 412 N. Oakhurst Dr., #202, Beverly Hills, CA 90210; tel: (310) 203-0800 (w); e-mail: <mmg@jmbm.com>

82 15th Reunion

Roger Pellegrini has worked for JP Morgan Bank since 1987 doing risk modeling.

What he and his wife, Marianne, find most challenging is keeping up with their twin 2-year-old sons! . . . **Joan Purdy Thayer** is still flying for Delta Airlines. She raises sheep and attends to her garden when she is not traveling. Her husband, Doug, flies for American Airlines.

Jeffrey Lee and **M. Kathryn (Kathy) Anderson Lee** announce the birth of their first child, Roxanne Christine Lee, on March 21. They live in New Jersey. Kathy <mkleee@erenj.com> does environmental research with Exxon corporate research. Jeff <lee@sol.essex.edu> is an assistant professor in the Biology Department at Essex County College.

Helen Kauder <helen.kauder@yale.edu> is the new director of licensing programs for Yale University. She will be looking for ways to mine Yale's intellectual property for potential royalty revenues, and will expand the existing licensing of athletic gear into overseas markets, initially in Asia. After 11 years at Citibank, she is looking forward to learning about life outside of financial services! . . . **John Allred** <jallred@rttimeinc.com> left Stratos (a small design consultancy) last

December and has joined RTime, a software startup in Seattle, working on developer tools for real-time Internet connectivity between hundreds of people at once. They are actively hiring Win95, NT, and Unix developers who are network, socket, multi-thread, and real-time savvy, and who have the will and ability to thrive in a chaotic, unstructured environment.

Robert Lourie got a PhD in physics at MIT in 1986. Afterwards he continued there as a postdoc then joined the physics faculty of the University of Virginia where he is now an associate professor. Along the way, he married Lisa Jeffery and they have two children, Alex, 6, and Julia, 4. Research includes study of the structure of nucleons (protons and neutrons) and nuclei with intermediate energy electron beams. This year he is on sabbatical doing something completely different—financial modeling for a firm that trades stocks and

commodities staffed by a group of mathematicians, computer scientists, and physicists who work on prediction problems. They do quite well and consider it the "Revenge of the Nerds."

David Shapiro is now happily married to Sandra Kogan. They were married in September after 18 months of long-distance commuting almost every weekend (first Rochester-Montreal, then Boston-Montreal). Ted Weaver, '83, and Paul Rothman, '80, went to the wedding. A three-week honeymoon included Hong Kong, Thailand, and Indonesia and now they are setting up their new place in Brookline. David still works at the Center for Biostatistics in AIDS Research at the Harvard School of Public Health in the area of mother-infant HIV transmission. Sandra works as a clinical research coordinator at Mass. General Hospital.

As for me, I just accepted a market development position at Sun Microsystems in the Interactive Services Group which is a startup within Sun doing media and video servers. Additionally, in June we moved into a newly built house.—**Helen Fanucci**, secretary, 502 Valley Forge Way, Campbell, CA 95008; e-mail: <fangroup@aol.com>

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Bryan Liang <bliang@pepperdine.edu> writes that after graduating from MIT, he's been on a long educational journey with a six-figure debt to prove it. Bryan was Course

V followed by a PhD at the University of Chicago in public policy studies in 1989. In 1991, he received an MD from Columbia University College of Physicians and Surgeons and in 1995, a JD from Harvard Law School. Bryan currently serves as an assistant professor of law at Pepperdine University in Malibu, Calif. . . . **Leslie** and **Alan Taylor** hosted an event in Boulder, Colo., for the local MIT alumni/ae club. The event, which was an artist studio crawl (the '90s version of a progressive party), was attended by 55 people. Alan works as a consultant to the energy business while wife Leslie is an accomplished portrait artist.

Cindy Pribble and husband **Greg Kochanski**, '82, now have two children, a girl, Kelly, born in September 1993 and a boy, William, born in April 1995. They are currently going through a lot of diapers. . . . **Kate Zebrose** is enjoying life with husband Don, '82, and their two boys, Alexander and Cordell, at home in Davis Square, Somerville. Kate works as a senior hardware manager for Telco Systems in Norwood, Mass. . . . **Ramin Khorram** has been getting lucky with his significant other. For Ramin, that means finding the perfect parking space on Newbury Street for his red Porsche 930 turbo.

Mark Hotta writes that he and his wife, Michiko, had their second son in December. Mark works at Ford Motor Co. as a manager of Powertrain systems engineering. He also swims competitively in the Michigan master's program and recently won the Detroit Council Autocross Championship in his 1995 Mustang GT. . . . Finally things are looking up for **Dan Schwinn's** company, Shiva. Goldman Sachs came out with a recommended list report on Shiva on April 22, 1996, claiming the company's growth is still accelerating. The company that Dan and his partner started is now worth

ClassNotes

\$1.75 billion.

Please keep those cards, letters, and research reports coming.—**Jonathan M. Goldstein**, secretary, c/o TA Associates, High St. Tower, 125 High St., Suite 2500, Boston, MA 02110; fax: (617) 574-6728; e-mail: <jgoldstein@ta.com>

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Got an update from **Glenn Fleisig** who has this to say: "After nine years with the American Sports Medicine Institute, I am still finding the work challenging and fun. As

director of research, I get to meet many famous athletes and participate in a variety of sports medicine research studies. This summer, we will be at the Olympics studying the biomechanics of baseball pitching and tennis serving. A couple of my old Burton House friends are also involved in the sports field; **Eric Fleming**, '83, is a financial analyst for ESPN, and **Adam Helfant**, '85, is an attorney with Nike. My wife, **Clara Chung**, '85, and I plan to stay in Birmingham, Ala., for a while, as it is a good place to raise our 2-year-old daughter, Emily."

Jesse Treger is living in Oregon and working for Intel in product marketing. . . . **Mark Radlauer** is happily married to **Linda Inez Carr** and enjoying life as an emergency physician in Denver. He keeps in touch with many FJI brothers and went sailing in the Caribbean this past spring. . . . **Kenton Yee** got a PhD in physics, did postdoctoral research for a few years, and is now in law school at Stanford. Friends can reach him at <kenton@leland.stanford.edu>.

Ed Coleman writes, "I am married with a daughter 3½ years old and a son 6 months old. I recently completed six years designing, developing, implementing, and testing fly-by-wire control laws for the Boeing 777. Now I'm working on control law concepts for future supersonic commercial airplanes." . . . **Karen Caswelch** had a second child in February. She has moved from product planning for GM's truck vans to the body shop of the plant that assembles full-size pickups and loves her job.

Thanks for sending in your updates. Keep 'em coming: **Jonathan Miller**, secretary, 1708 Plaza Ct., Mountain View, CA 94040; tel: (415) 961-2394; e-mail: <jdm@diamondsys.com>

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Greetings everyone and apologies for the hiatus in the column in July. There is a bunch of news from long-lost classmates this month.

Ann Dalton writes, "I'm about to enter my tenth year at JPL; still working in the science instrument area, which is really just performing junior lab experiments in space. In my free time I'm learning more about wine and I'm dancing hula, never both at the same time!" . . . **Merit Cudkowicz** sent the following e-mail: "I am at MGH, as an instructor of neurology. I was married April 2, 1995, to Eugene Sorets. I finished an

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MD at HST in 1990, intern in medicine at BIH, and then residency in neurology at MGH. I am interested in experimental therapeutics of neurodegenerative disorders such as Lou Gehrig's disease, Parkinson's disease, and Huntington's disease." . . . **Max Hailperin** was promoted to associate professor of computer science with tenure at Gustavus Adolphus College. . . . **Ondria Wasem** has been promoted on the technical ladder at Bellcore to senior research scientist.

What ever happens to old LSC people? Well, **Gail Standish** tells us. "My husband **Howard Blakeslee**, '81, **Doug Leber**, and I were privileged to host the ninth annual shindig for LSC folks this year in L.A. as opposed to the usual Boston, Cleveland, Baltimore, or Dayton locations. The attendees for the West Coast party were **Ken Weems** and his wife, **Molly (Wellesley '87)**, **Rim Cothren** and wife **Daphne (Dodds) Cothren (Wellesley)**, **Karla (Stickley) Strong** and **Gordon Strong**, **Kerstin Calia (Wellesley '85)**, **Bill Short**, **Jamie Hicks**, '86, and spouse **Sharon Chang**, '87, and **Tim Bezanson**, '86. People started arriving on December 27, and some hung around until January 3. We had a great time—some went whale watching, others to museums. There was a lot of catching up and hanging out (we're all LSC, so we *had* to go see at least one movie). As for news: I'm an attorney in L.A., practicing mostly intellectual property litigation. My husband is still in the Air Force (he can retire in 2001). **Doug Leber** has been working for Hughes Aircraft (in their Space and Communication Division) for a few years now. He even managed to get Hughes to send him to Bangkok a while back. Other than myself, the rest of the gang has remained appropriately techy. They're really a refreshing change for me from the world of attorneys! Next year, our 10th Reunion, may happen in Hawaii (or maybe, since everyone splurged for plane tickets this year, it'll be back East somewhere). In any case, it's always an event we look forward to. We never forget our motto. LSC—SUX!"

Erik Devereux and wife **Olivia**'s son **Alexander** was born on March 26. Fearless Leader **Inge Gedo** and **Wayne Applewhite** had a son, **Anthony**, on December 1, 1995. **Lora Silverman** and husband **Keith Stolzenbach**, gave birth to **Victor** on April 8. **Dave Sherman** and wife, **Susan**, gave birth to a daughter, **Martha**, on Valentine's Day.

Send news to **Bill Messner**, secretary, 5407 Pocusset St., Pittsburgh, PA 15232; tel: (412) 421-4334; e-mail: <bmessner@cmu.edu, Class of 1985 listserv: <mit1985@mitvma.mit.edu>.

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Please send news for this column to: **Bill Hobbis**, secretary, 5 Cappy Circle, West Newton, MA 02165; e-mail: <mit1986@mitvma.mit.edu>

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10th Reunion

Our 10th Reunion is coming! By the time you read this, planning should be well under way. If you live in the Boston area and are interested in being part of the reunion commit-

tee, please contact me, either by phone or e-mail, and I will put you in touch with the right people. Also, if you have any ideas for reunion activities, let me know (anyone for an Orange-line tour reprise?). I had the opportunity to visit Boston for the reunion kickoff meeting this past April 10. Attending from our class was **Victor Steinbok**, who lives in the Boston area, and is freelancing for Prentice Hall Technical Publications. We had fun reminiscing about things, including the run of "Stove and Cat" for the positions of UA president and VP.

Steve Russell writes, "We have just bought a house in North Dallas, and have gotten an Australian Shepherd puppy to go with it. Her name is **Argess**—named after Ulysses's dog **Argus** who waited for him patiently during the Trojan War. She is extremely active, cute, and helps keep the cats in line." According to the header on Steve's e-mail, he works for **Texas Instruments**. . . . **Tom Nichols** just started in March as a product marketing manager at **Spectrum HoloByte** in Alameda, Calif. He is responsible for all of the company's flight simulation games, including the well-known **Falcon** product line as well as games based on the movie *Top Gun*. He is pleased to have found a fun job that marries his Course XVI background with his marketing/MBA interests. And the best part is that he is being paid to play computer games! Life is good in California—besides work, Tom completed his private pilot license and bought a "kick-butt" sports car—no wife, no kids, no worries!

David Schultz successfully defended his doctoral thesis in atmospheric science at the State University of New York at Albany. It was titled, "The effect of large-scale flow on low-level frontal structure and evolution in mid latitude oceanic cyclones." As of August, David will have moved to the National Severe Storms Laboratory in Norman, Okla., to take up a National Research Council associateship studying the structure and evolution of fronts and cyclones over the Western United States. (It is nice to see that someone is actually doing something about the weather, instead of just talking about it!)

Rovena Sobarzo lives in Indianapolis and works as a manager in Endocrine Research at **Eli Lilly and Co.** She spent about five months last year in Belgium on a company assignment. She enjoyed the traveling (and the chocolates!). **Rovena** is eager to hear updates from fellow 3rd East (East Campus) and Course X alumni/ae. . . . **Deborah Hutchins** is section head for product safety in the Laundry and Cleaning Products sector at **Proctor and Gamble**. She lives in Cincinnati with her husband, **Robert**, a physician, and 2-year-old son **Stephen**. . . . **Vannessa** and **Todd Abler** had a baby boy, **Nicholas Keith "Cole"**, on March 22. The **Ablers** lives in Oak Harbor, Wash., where **Todd** is a pilot with the U.S. Navy.

Please send in details of those summer vacations! Inquiring Minds Want to Know!—**Jack Leifer**, secretary 116J Fairway Ridge, Aiken, SC 29803; tel: (803) 642-3900; e-mail: <leifer@sc.edu>, <mit1987@mitvma.mit.edu>

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Last week I was Rollerblading in front of Killian Court and found myself about 15 feet away from **Al Gore** and a bunch of guys in suits talking into their collars. He must

have been there to discuss his graduation speech since he is this year's keynote speaker. I am looking forward to graduation since my husband, Andy Singer, '89, will be receiving a PhD in electrical engineering. . . . **Tupper Hyde** will also be receiving a PhD in Course XVI at this year's big event. . . . **Adam Schwartz** will be graduating from Berkeley with a PhD in electrical engineering. His dissertation was on numerical methods for solving optimal control problems. Adam was just in Boston interviewing and spent some time with **Larry Candell** and his wife, Amy (Bertin '87).

One of **Pat Gabridge's** plays, *Reading The Mind of God*, is being performed at the Chameleon Stage in Denver. It is about a fierce struggle of wills between the astronomers Kepler and Tycho in the year 1600.

Please send news for this column to: **Catherine Suriano Singer**, secretary, 131 Main St., Andover, MA 01810; e-mail: <singer@mit.edu>

89

Greetings, I hope everyone has had some nice summer vacations—write in about them (hint hint)! This month's list of people to please send news is: **Paul Davis**, **Kimberly**

Haskins, **Sandra Lugo**, **Grant Schaffner**, **Peter Tan**, and **Kendra Williams**. What are y'all up to? If anyone knows about any of these people or anyone else, please write in.

Mike Fincke has been selected for astronaut training. Mike, who is a captain in the USAF, is currently stationed in Gifu AB, Japan, and is currently an XF-2 flight test liaison. . . .

Christy and **David Story** are expecting their first child this August. David, who is working at SGI, has been managing a large software project—creating the first VRML 2.0 authoring system, released this summer. . . . **Jeff Applebaum**, San Jose, Calif., reports that he and his wife Johanna enjoyed the birth of a baby boy, Joshua Seth, on March 28, 1996. "He was 7 lbs., 10z., and very healthy. The experience of childbirth was amazing!" . . .

Jarrod Todd Fraser and **Shawn Tiffany Williams**, '90, are engaged. The wedding will be held August 31 in Hampton, Va. The couple will honeymoon in Jamaica and reside in Long Beach, Calif. Shawn, a member of AFROTC while at MIT, will be working as an Air Force attorney at Los Angeles Air Force Base. Jarrod is chief resident in the anesthesiology department at the UC/Irvine Medical Center.

Eric Reifschneider writes, "Getting married, changing jobs, and moving are said to be three of the most stressful things in life. For those who have chosen to follow the legal profession, taking the bar exam would also make the top five. By the end of the summer, I will have survived (I hope) all of the above. On August 17, I will be married to **Geesoo Javanmardi**. **Geesoo** (the name is Persian) has an MBA and manages the software training program for an international shipping company. We met in September 1995 when a mutual friend introduced us while I was on a business trip in San Francisco. After we became engaged in February, we decided that Northern California, rather than northern Illinois, would be a better place to live (the -20 temperatures in Chicago

might have influenced our decision a bit!). Motorola has no offices in the Bay Area, though, so in August I will join a law firm in Palo Alto, **Cooley Godward Castro Huddleson & Tatum**, where I will have a general corporate law practice specializing in information technology licensing. The wedding will be held at the Palace of Fine Arts in San Francisco, and we will honeymoon in Athens, Istanbul, and Paris. It will be quite a summer, and I trust that the future will be equally challenging and equally rewarding."

Ed Kim has recently been promoted to director of Emerging Markets and Asian Equity Trading in the London office of **Lehman Brothers**. "My focus countries are India, South Africa, and Hong Kong, and the department as a whole is active in the other Asian and sub-continental markets. I'm excited about helping to build this business in London, and it should mean a frequent flyer mile here and there." Though Ed enjoys his job, "without a doubt the best part of this time has been the chance to travel throughout Europe and the Middle East." . . . **Thomas Bartman** graduated in May from Temple University in Philadelphia with an MD and a PhD in molecular biology. He will do a pediatric residency at UC/San Francisco with a postdoc fellowship to follow. . . . **Veronique (Stassen) Bartman** received an MD from Temple in 1993 and has now finished a family practice residency. She will be starting practice in the San Francisco area. They are both looking forward to exploring the Bay Area and meeting many MIT alums.

Ed Tan left Dataquest early this year and is now a manager of National Semiconductor Asia Pacific's newly created Market Intelligence & Research Unit. Ed, who is doing semiconductor market research, sees a lot of infrastructure development and other hot business opportunities in Asia. . . . In February, **Lori Tsuruda** started working at St. Francis House Day Shelter and Programs for the Poor and Homeless in Boston's Combat Zone. "I am the development associate, which is a fancy way of saying that I edit the quarterly newsletter, put together the calendar of guest art work and poetry, organize special events, do media relations, and anything else needed. St. Francis House is a nonsectarian, comprehensive day shelter, the largest in Boston. A few MIT alumni/ae and former staffers volunteer regularly at St. Francis House, but what really surprised me was a visit by **Thomas Huang**, '88, for a story he was writing for the *Dallas Morning News* in Texas. Thomas was a familiar face on the fourth floor of the student center, where *The Tech* staffers and APO brothers were usually found." Lori also continues to run **People Making a Difference (PMD)**. "We have recruited over 500 active volunteers to date. About 10 percent of our volunteers find us on the Web, <<http://www.pmd.org>>, and half use e-mail to sign up for PMD community service projects. PMD will be featured in an article on volunteerism and the Internet in *Home PC Magazine* next month."

Laird Mamed has been working at Activision for the past year and three months. Laird was technical director for the adventure game **Zork Nemesis** for the PC and soon for the Mac. . . . **Barak Yedidia** is now senior technical instructor at Tencor Instruments in Milpitas, Calif. They make semiconductor manufac-



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turing equipment and supply companies like Applied Materials and Lam Research as well as the manufacturers themselves, such as Intel. "My new position will be much like my position at GE in that I will be training customers; however, I will be in a larger training organization that is currently growing and will be provided the opportunity for career advancement within training." . . . Michael Gobler appeared in an April 5 *Boston Globe* feature titled, "Contestant left with egg on his face." Three photographs featured Michael in the process of catching an egg dropped from the top of a 20-story building. "The crowd counted down from ten, the egg began to drop. Like an outfielder, I tried to position myself directly under it. I held up the frame, and brought it down to cradle the egg as it touched it. There was the egg, *unbroken*, but rolling off the end where the fabric wasn't attached to the frame! I tried to slide under it, but the egg bounced off my leg and onto the asphalt, where it cracked." Michael barely missed winning the prize, a dream vacation for two to Hawaii. For more details and photographs, check out: <http://www.voicenet.com/~alg64/gallery/egg_catch/>.

Well, that's it again for this month. More members of the class have home pages, so be sure to check out the '89 home page at <<http://www.tns.lcs.mit.edu/mit89/>> and send your URL if you have some info. Please send in news!—Henry Houh, secretary, 4 Ames St., Cambridge, MA 02142; tel: (617) 225-6680; fax: (617) 253-2673; e-mail: <hnh@mit.edu> or <henry_houh@mit.edu>

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I've got a ton of news from lots of folks so let's get started.

Babies! Justina Snyder Zuckerman, Jennie Snyder's and Dave Zuckerman's first child, was born February 22,

1996, and weighed 6 lbs., 14 ozs. Jennie reports "We are all doing great; Dave is finishing up a master's in teaching and will be in the classroom this fall. Justina is a really cool baby and takes up most, not all, of my time. I'm typing this e-mail one-handed because she is sleeping on my lap, and sleep is basically the hardest thing to get her to do (eating, crying, not problems)." . . . Also reporting a new child are Fred Kennedy and Vicki (Garabino) Kennedy, '91. Brendan was born April 24. Mom, Dad, and baby are well.

Congratulations to Shawn Tiffany Williams and Jarrod Todd Fraser, '89, on their engagement! The wedding will be August 31, 1996, in Hampton, Va. The couple will honeymoon in Jamaica and reside in Long Beach, Calif. Shawn, a member of AFOTC while at MIT, will be working as an Air Force attorney at Los Angeles Air Force Base. Jarrod is chief resident in the anesthesiology department at the UC/Irvine Medical Center.

Tim Dawson-Townsend has the following update: "I am now a captain in the Air Force and am currently at the Defense Language Institute in Monterey, Calif., learning German for six months. After that, I will be heading for Germany as part of the Air Force's engineer and scientist exchange program. For two years I will be working in a German laboratory, the DLR, essentially the German equivalent of NASA. I will be working with their flight simulation research section, on both ground-

based and in-flight simulators. When I get to Germany, I will catch up with Aras Suziedelis, who is at Ramstein Air Base working in the intelligence area. He reports that he has been up to 'only' 136 mph on the autobahn."

Michael R. Dixon writes: "I recently got admitted to Sloan's master's program and will be attending this fall. My wife and I are expecting our third child this November, so the going will be rough. I've been fairly busy though. As a consultant at Public Financial Management, I have been working with our premier client, the District of Columbia. We designed a turnaround plan for them to help them regain their financial solvency. I was fortunate enough to work with the Department of Human Services which, among other things, is tasked with administering the District's Medicaid program. As Medicaid is almost one fifth of their \$5 billion budget, I gained significant visibility and also participated in some meaningful work that impacts many people. Wish me luck this fall and over the next two years. Donations will be accepted gladly."

Jon Woodman writes: "A great deal has happened since we graduated in aero-astro. First off, I ran screaming from aero-astro as soon as I had sheepskin in hand, and went directly to law school at Ohio State. While many people figured I would go into patent law, I instead opened my own practice and handle mostly criminal defense cases. This summer, I will be arguing my first case before the U.S. Court of Appeals for the Sixth Circuit. On a personal note, on March 16, 1996, I was married to Cheryl Duda, Wellesley '92. She got a biochemistry degree from Wellesley, and a biochem master's from Ohio State. She is now becoming certified to teach high school science and will begin teaching this fall. Other MITers at the wedding included the best man Thomas Knight, David Berger, and the bride's brother, James Duda. Cheryl and I are active in the MIT Club of Central Ohio and are very glad we got hooked into this group. Also, I am happy to serve on the MIT Educational Council (which is just a fancy way of saying that I go out to schools to talk about MIT and I interview applying students). The best part of being an EC is that I get to keep up with what's happening on campus in a way that I never would otherwise."

Class treasurer Charrissa Lin has accepted an offer from the Boston Consulting Group. "I will start in their Chicago office in late August of this year. My official title is consultant (gee, sounds a lot like my unofficial title). I'm pretty psyched—in September they'll be sending me to a business essentials program (mini-MBA type thing) in Amsterdam. I'm going to the Olympics this summer, too. The person I'm road tripping down with has a ticket to the water polo venue—but only one, so I won't get to go." . . . Erica Kuo and Bart Giddings, PhD '94, placed second in the national Moot Court competition for the patent bar! Both are second-year law students at Stanford. . . . Don Euwart wrote to rub in the awesome skiing out East this past winter: "Had the best day of skiing in the East that I have ever had in my life last weekend—12 inches of fresh powder Friday night, 6 inches more Saturday night, bright sunshine with temps in the low 40s. Then I went M. biking the day after in 60-degree sunshine. You can't tell me you don't miss the weather in New England." Just watch me, Don. Better yet, read Elena's update.



An "awesome spring break in Maui" from (left to right) Kourtney Leabourne, '92, Mike O'Connor, '92, Christine Harada, '94, Max Ochoa, '90 (class secretary), Alissa Fitzgerald, '90, and George Pappas, '88.

Elena (Koutras) McFann writes: "In honor of our first wedding anniversary, my husband and I decided to give each other a mortgage! We've bought a great house in Long Beach, and we'll be all moved in by mid May. I continue to love my job in the Health Care Consulting practice in Ernst & Young's Los Angeles office, and Mike and I enjoy all the sun and fun of Southern California—golf, fishing, sunning. Life's a b__h and then you die and go to Southern California!" . . . Yvonne Grierson will be leaving 3M and heading to the U/Minnesota medical school this fall. Congratulations! Always an awesome athlete (Div. III Swimming record-holder), she's been working out. "I haven't started counting down the days yet, but it's getting closer. It does look like I'm going to be able to put in for a couple of patents before I go, a nice way to finish up. It's still freezing here but I have started training a bit more. I did a 100-km ride last weekend and my running is up to 15–20 miles/week. Now if I could only remember where the pool was. . . . I actually played in a small polo tournament recently—scary!—thankfully we are talking low skill levels around here, but I haven't played a full court game in a couple of years! P.S.—You've got to try the triathlon stuff!" . . . Yvonne also reports that Chris Rosenwasser will be doing a pediatrics residency at Childrens Hospital in L.A. . . . Rudayna Abdo is working as an urban planner in Toronto and would like to hear from Shahrnaz Motakef, Priti Paul, Anastasia Koutsolioutsou, and other old pals. Send in some updates!

Jema Gonzales also has surfaced! "After MIT did the two years of work thing in Boston (living with Beth Kulas). Then I went to Wharton to do the MBA thing, graduating in 1994. Since then, I've been working in the wonderful industry of management consulting for A.T. Kearney. I've had the dubious luck of working on all really high-burn projects. There are only a handful of Bakerites that I have managed to keep in touch with: Teresa Zimmers is getting a PhD at Johns Hopkins; Betty Chang, '91, is doing a residency in internal medicine in the Chicago area." Good to

hear from you, Jema.

Some quick news from me. My first year of law school is almost over with exams starting in a few days. I'll be working for Arnold, White and Durkee, an intellectual properties litigation firm here in Palo Alto this summer. I made my debut in the world of stage and screen in the Stanford Law School musical a few weeks ago. I actually sang a solo! Subjected to this abuse were Dave Berners and Andy Barrows, '89, who were part of the musical band. Dave is working toward a PhD here at Stanford in the Center for Computer Research in Music & Acoustics, and Andy is finishing up a PhD in aero/astro at Stanford. Had an awesome spring break in Maui (see photos) with Alissa Fitzgerald, Christine Harada, '94, George Pappas, '88, Mike O'Connor, '92, and Kourtney Leabourne, '92. All are Course XVI grads and Stanford advanced degree pursuants or holders. We saw whales and heard them singing underwater, did a ton of skin- and scuba-diving, tanning, hiking, etc. I highly recommend a trip if you've never gone.

Have you sent in a little note to your humble class secretary in the last year? Ever? You'll be the most popular kid on the block if you do! Hope to hear from you soon.—Max Ochoa, secretary, 10726 Red Arrow Hwy., Bridgman, MI 49106; tel: (616) 465-3257; e-mail: <mchoa@leland.stanford.edu>, <mit1990@mitvma.mit.edu>

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Please send news for this column to: Andrew Strehle, secretary, 59 Commonwealth Ave., Apt. 4R, Boston, MA 02116; tel: (617) 450-0637; e-mail: <astrehle@brfg.com>

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5th Reunion

Please send news for this column to: Leslie Barnett, secretary, 2644 Vrain St., Denver, CO 80202; tel: (303) 433-447; e-mail: <labarnet@ouray.cudenver.edu>

ClassNotes

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Please send news for this column to: Mari Madsen, secretary, 85 Alberta Rd., Brookline, MA 02167; e-mail: <mmdadsen@opal.tufts.edu>

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Please send news for this column to: Jeff Van Dyke, secretary, 6000 Shepherd Mountain Cove #1401, Austi, TX 78730; e-mail: <jvandyke@trilogy.com>

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Welcome to another edition of the Class Notes! Congrats to all those who have graduated from MEng programs this year; send me your current information as soon as you

are settled down! Congrats to Loretta Vidos, who will be marrying Nicholas Pioch, '94 (MNG '95), on June 1 at St. Paul Church in Harvard Square! The wedding party includes Bryan Oh, Eliza Fulton, Karin Lin, Jose Elizondo and Ben Moskowitz ('94), ("and there's just a pile of nerds...er...MIT students/alums that are invited to the wedding!") Loretta writes). She plans on finishing an MNG in EE&CS in December. Karin, who is currently pursuing a PhD in physics at UC/Berkeley, has been engaged to Cade Murray, '96, as of last New Year's Eve. The two played the leading couple in the MIT Gilbert & Sullivan Players' production of *The Mikado* in fall 1994, and are planning a summer 1997 or winter 1997-8 wedding. Karin reports that two other MIT alums in the physics program at Berkeley are Celeste Winant and Ted Baltz.

After rotating through various and sundry labs, Victor Holmes and Meghan Bowser have finally settled down into their five-year relationships with one professor in the UC/Berkeley PhD program in biology. Victor will be working with Nick Cozzarelli on enzymes important for general recombination, and Meg will be working for Carolyn Kane on transcription elongation. . . . Stan Thompson, who is at USC law school, spent spring break with Victor and Meghan this year. They showed him around San Francisco and then went wine tasting in Sonoma County. Stan received an offer from Graham & James (a very big international firm) for a one-week Intellectual Property Internship this summer.

Also in the sunny state of California is Eric Fong, who completed a master's in mechanical engineering at Stanford University and plans to spend the next three quarters of his life away from school (finally!). In August he will be starting a job at Allied Signal Aerospace in Los Angeles. . . . Fred Hernandez recently finished a master's in mechanical engineering at Stanford as well. He writes, "Imagine that! A crazy Mexican with a master's degree. I guess that means I gotta grow up now huh? Nah! Growing up only leads to growing old and dying. I'm not ready for that yet." . . . Also in California is Beth Siers, who recently accepted a year-long job at PCPA Theatrefest in Santa

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Maria as one of their costume interns.

Karyn Green says that schoolwork in the nuclear engineering program at University of Illinois has kept her pretty busy. She is looking forward to a change of pace this summer, when she will be working at Sandia National Laboratories in New Mexico. . . . Another person already in the sunny climate of the Southwest is **Erika Hanley**, who is playing sand volleyball in the desert when she's not working as a process engineer in the lab at Intel in Phoenix. The heat is making her feel like a piece of southwestern beef jerky! "No more personal news, just working on my sunburn," she says. . . . Down south in Hawaii, **Eliza Fulton** is in the same program as **Chad Trujillo** in astronomy at University of Hawaii. She says the island is beautiful. . . .

Speaking of islands, **Wynne Kwan**, who is in the master's in city planning program at Columbia, traveled to Vieques, Puerto Rico, in March to work on a studio project for the Committee for the Rescue and Development of Vieques, a community group on the island. Two-thirds of the island, which is located off the southeastern coast of Puerto Rico, is Navy land, and Wynne's project was to come up with a development plan assuming that 8,000 acres of the Navy land would be given back to the Viequenses. She says the island was beautiful and that it was an amazing experience. (She also came back very tan!) At the end of May, she was planning to go to Albania for two weeks with a group of fellow students. They were all on a travel fellowship to study the transition of the communist regime to an open-market economy. . . . After finishing an MNG thesis at the Media Lab, **Eugene Lin** is off to the West Coast to work for Microsoft. He will be a program manager in the Multimedia/Games group, and will be living with **John Yu**, who is also headed for Microsoft. . . . **Chris Ellefson** is finishing class work and starting his thesis for a master's degree in computer science at the University of British Columbia. He is active in the UBC chapter of his fraternity, Phi Delta Theta, but says that the Greek system there is much smaller than MIT's. This year he was able to compete on the UBC gymnastics team, which came in second in Western Canada, and he also holds a couple of executive positions on the Computer Science Grad Student Society, and the UBC Grad Student Society Council.

James Landry didn't like Chicago much at first but says that the city is growing on him, especially now that he is meeting more people with cars! He has started research with **Arieh Königl** at the University of Chicago on periodic eruptions (called FU Orionis outbursts) in accretion disks of forming stars, and will be staying there for the summer. . . . This summer **Alice Lin** will be at the Office of Management and Budget in Washington, D.C., writing a review of the Human Genome Project for the DOE/NIH. She and **Carrie B. Miller** are at the Kennedy School of Government, located at the Little Red Brick Schoolhouse. . . . **Raj Sodhi** hopes to have completed an MNG in EE in June after getting through a killer term. . . . **Francesca Paik** starts a job with J.P.Morgan in October 1996, and will be living at home in NYC. In her last term at MIT, she was playing Korean drums a lot, and had planned a trip to Texas to perform at KASCON (Korean-American Students' Conference). This summer she

was traveling in Southeast Asia for three or four months.

Holly Goo, who just finished an MNG in environmental engineering, is off to University of Maryland School of Law in Baltimore next fall. . . . Congrats to **Ben Reis**, who is a recipient of the prestigious Marshall Scholarship. He plans to undertake a two-year project at Cambridge University combining music theory, experimental psychology, cognitive neuroscience, and computer science in a computer-aided study of music cognition and learning in preparation for a career in medicine and/or research. . . . **Garlen Leung** is currently living near Albany, N.Y., and is working as a materials scientist at General Electric's Corporate Research and Development Center on some cool projects. He talks to **Gilbert Leung** a lot, who is still at MIT completing the Course 6 master's. He's also in contact with **CheeKian Ooi**, who is working for Salomon Brothers in NYC. . . . Also in the NYC area is **Veej Sankaran** who is working for Ernst & Young, but is currently doing consulting work in Princeton, N.J. . . . Another employee of the same management consulting firm is **Ken Vollmer**. . . . **Pradeep Sreekanthan** (who had taken a term off to return to India) and **Ling Liao** stayed at MIT to complete their Course 3 master's degrees. . . . **Rosalidia Tamayo**, another materials person, is now working at Intel in Arizona on a rotation program. Unfortunately, her boyfriend **Albert Lau** is far away at Stanford doing the med school thing.

In early February, there was a big banquet for *The Tech* where a number of alumni/ae attended, including **Matt Konosky**, who is working at King Industries in Connecticut, **Eva Moy**, who is still at MIT working towards a master's in Course 2; **Sarah Keightley** who is working in a biochem lab at the Mayo Clinic in Arizona; **Pradeep**, **Patrick Mahoney**, '94, and many older alums. A good time was had by all.

Keith Jackson is still at MIT in the Leaders for Manufacturing Program. He'll be on an internship at Pratt and Whitney for the summer and fall, then he'll be back to finish up next spring. In June '97, he'll get two masters degrees, one from Sloan and an aero/astro degree from the School of Engineering. He's the only aero/astro student in his LFM class, and encourages any other aero/astro grads with a manufacturing interest to apply to the program. . . . **Anthony Patire** is continuing on in Course 6, in the PhD program.

Others in the Boston area, **Sumer Johal** is working in the operations research department of Analog Devices in Wilmington, Mass., . . . **Roberto Almeida** is working for Pilot Software. . . . **Kimberly Mazzocco** is working at Thomson Financial Services, First Call Corp., in Boston, while taking a couple of years off before Columbia law school.

And I'm still plugging away at IDX Systems Corp., a company that develops health care information systems here in Boston. I actually went down to Florida for a week-long conference on software testing and had a wonderful time enjoying the weather and watching a space shuttle launch!

That's all for now folks. Those of you getting married, send some pictures my way!—**Ranjini Srikantiah**, secretary, 21 Beacon St., Apt 2T; Boston, MA 02108; e-mail: <srikantiah@idx.com>

CourseNews

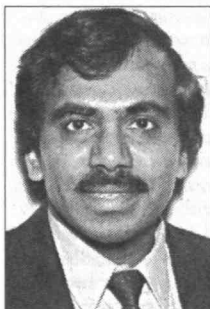
CIVIL AND ENVIRONMENTAL ENGINEERING

Olivia R. West, PhD '91, and Robert L. Siegrist, researchers in the environmental sciences division at the Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL), had a three-part series of papers addressing the cleanup of volatile organic compounds published in the *Environmental Science and Technology Journal*. The journal, sponsored by the American Chemical Society and considered one of the top scholarly publications in the environmental science field, focuses on environmental chemistry and remediation technology. The Siegrist and West papers describe how their team used complementary laboratory, field, and modeling studies to develop and demonstrate in-situ mixed region vapor stripping for successfully removing trichloroethene (TCE) from clay soil at DOE's Portsmouth, Ohio, gaseous diffusion plant. In-situ methods decontaminate and remediate soil in place, without removing it for treatment and replacing it. Beginning in 1992, the interdisciplinary work spanned four years from performing and documenting their project to publication by the journal. West earned BS and MS degrees in civil engineering at the University of the Philippines, in her home country. She joined ORNL on a Wigner Fellowship, the highest entry-level honor a scientist can obtain at ORNL. Her research interest is the remediation of volatile organic compounds in the environment. West and her husband, Brian, live in Kingston with their three dogs, Boomer, George, and Snoopy. . . . Carl A. Gowan, SM '76, writes: "I am the president of C.A. Gowan, Inc., and counsel pension funds, corporations, and financial institutions on appropriate strategies for their real estate portfolios." . . . Brian J. Davis, SM '84, PhD '90, writes: "I am completing a residency in radiation oncology at the Memorial Sloan-Kettering Cancer Center and have accepted a staff position in the division of radiation oncology at the Mayo Clinic in Rochester, Minn."

MECHANICAL ENGINEERING

Subra Suresh, ScD '81, the Richard P. Simmons Professor of Metallurgy and professor of

mechanical engineering at MIT, recently received several international honors. He was elected an honorary member of the Materials Research Society



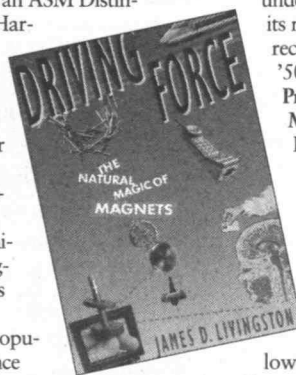
Subra Suresh

of India and a Fellow of the American Society of Mechanical Engineers. He also delivered the Sauveur Lecture to the New England Chapter of the American Society of Materials International and the closing plenary lecture at the international conference, Fatigue '96. The conference, which has more than 350 speakers from dozens of countries, was held in Berlin during May with the German Materials Society as the host.

MATERIALS SCIENCE AND ENGINEERING

Gordon E. Forward, ScD '66, the president and CEO of Chaparral Steel Co., in Midlothian, Tex., was elected a member of the National Academy of Engineering. He was chosen "for contributions to technical advances in steel-making and metals recycling." Forward is also an ASM Distinguished Life Member. . . . Harvard University Press recently published *Driving Force: The Natural Magic of Magnets* by James D. Livingston, a senior lecturer in MIT's Department of Materials Science and Engineering. The book was inspired by a freshman seminar on "The Magic of Magnets," which Livingston has been leading at MIT.

"Although magnets are a popular topic for children's science books," Livingston said, "I believe my book is the first popular-science book on magnets written primarily for an adult audience." He added that he hoped the book would increase the public's appreciation of science, par-



ticularly "magical magnets," and increase public recognition of the field of materials science. Livingston, who came to MIT in 1989 after 33 years in materials research with General Electric, holds a bachelor of engineering degree in physics from Cornell University, and an MA and PhD in applied physics from Harvard. He is a member of the NAE. A review in *Booklist*, a publication of the American Library Association, calls the book "a stimulating mix of science, history, and technology delivered enthusiastically" with "crystal clear explanations." . . . Craig R. Barrett, Intel Corp.'s executive VP and COO, delivered the 1996 Harry C. Gatos Distinguished Lecture at MIT in April. In his talk, "Technology Futures for the IC Industry," Barrett outlined the evolution of the semiconductor industry and made projections regarding the industry's future. He examined some of the more complex integrated circuit devices in production and talked about the technical challenges of bringing such devices to market. He also touched upon "Micro2010" (forecast for typical integrated circuit device in the year 2010) and looked at some of the key technology issues that will need to be addressed between now and then. Finally, he concluded with a discussion of ways in which industry, government, and university can and should cooperate in order to continue to make advances. The Gatos Lecture and Prize is awarded every two years to an individual who has "contributed significantly to the advancement of processing of electronic materials, to the understanding of their electronic behavior, and its role in electronic applications." Previous recipients are Professor Harry C. Gatos, PhD '50 (V), Dr. Tsuneo Nakahara, and Dr. Praveen Chaudhari, SM '63, ScD '63. . . . Michael F. Rubner, PhD '86, the TDK Professor in the Department of Materials Science and Engineering at MIT, was one of the faculty members selected as a MacVicar Faculty Fellow in February in recognition of outstanding classroom teaching, major innovations in education, and dedication to helping others achieve teaching excellence. MacVicar Fellows serve 10-year terms. The fellowships provide an annual scholar's allowance to assist each Fellow in developing ways to enrich the undergraduate learning experience. MIT will ultimately commit \$10 million in endowment to support the program. The goal is to have 60 to 80 MacVicar Faculty Fellows

DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering

ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering

MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science



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Andrew F. McKown, SM '78
Keith E. Johnson, SM '80
Elliott I. Steinberg, SM '80
Gretchen A. Young, SM '86
Alec D. Smith, PhD '89

architectural firm specializing in transportation and higher education facilities. Since its inception in 1981, OAA has grown to a full-service architectural firm with a staff of 50 architects and technical design professionals serving major public transportation agencies and private and public academic institutions such as Harvard University, MIT, and the University of Massachusetts. In over 20 years of professional service, Ondras has been active in numerous professional organizations, including the American Institute of Architects, the Boston Society of Architects, Women's Transportation Seminar, New England Women in Real Estate, and the Society of College and University Planning. A native of Northampton, Mass., and current resident of Lexington, Ondras received a BA in architecture from UC/Berkeley. . . . Alex Loy Seid, MAA '74, reports: "I assumed a new position as the director of development for aviation projects at Ogden Aviation Services in New York City. Our focus is on airport privatization worldwide. I had dinner with Professor Tunney Lee and Ren Lu, MAA '73, while on a business trip to Hong Kong." . . . Rives Taylor, SM '88, writes: "For the past two years, I have been the campus architect and university planner at the University of Texas/Houston Health Science Center. I'm in the midst of running a national design competition for a health-care teaching facility that meets 21st century needs, and I continue to teach at the University of Houston College of Architecture. I have been in Houston for six years with my wife, Martha Brousseau."

The Association of Alumni and Alumnae was notified that William Isidore Goodman, MCP '52, a professor of urban and regional planning at the University of Illinois/Urbana, died on December 23, 1995, and Rear Admiral M. Wayne Stoffle, MAR '40, USCGR (ret.) of Metairie, La., died on January 10, 1996. No further information was provided. . . Raymond Kermit Thompson, SM '32, of Vancouver,

Wash., died on November 13, 1995. He and his wife operated the architectural firm of Thompson & Thompson in Portland. He was a registered architect in Oregon, Washington, Idaho, Ohio, Connecticut, and New York. In the 1950s, he was district architect for Portland's public schools. He also was an associate professor in engineering at the University of Portland from 1965 to 1983. Previously, he had been an associate professor of architecture at Ohio State University and a member of the architecture faculty at Wentworth Institute in Boston. He received a BA from the University of Oregon in 1929. While at the university, he met his wife, Lillian Povey, also an architectural student from Portland. They married in 1929 and pursued graduate study at MIT, she as Polly Thompson, '38. During World War II, Thompson served in the U.S. Navy in North Africa, Italy, and in the Department of the Navy headquarters in Washington, D.C. He was a lieutenant commander. Returning to Portland in 1948, he opened his own practice, and was joined by his wife as a partner in 1953. She died in June 1994. Thompson also was state president and a national trustee for the Sons of the American Revolution.

V CHEMISTRY

From the MIT Department of Chemistry; Rick L. Danheiser, the associate department head, and Robert J. Silbey, the Class of 1942 Professor of Chemistry, were selected as MacVicar Faculty Fellows in February in recognition of outstanding classroom teaching, major innovations in education, and dedication to helping others achieve teaching excellence. MacVicar Fellows serve 10-year terms. The fellowships provide an annual scholar's allowance to assist each Fellow in developing ways to enrich the undergraduate learning experience. MIT will

when the program is fully implemented. Thirty have now been appointed.

In a recent realignment of several of its engineered materials sector businesses, AlliedSignal, Inc., named David Hill, '69, SM '69, PhD '70, president of the newly created specialty chemicals group. The group, which is located in northern Germany, is composed of AlliedSignals' Riedel-Haen specialty chemicals, performance chemicals, performance additives, and UOP businesses, and European business support unit. Hill joined AlliedSignal, an advanced



David Hill

technology and manufacturing company serving customers worldwide with aerospace and automotive products, chemicals, fibers, plastics, and advanced materials, in 1980. . . . Rakesh K. Popli, ScD '80, a senior research scientist at S.C. Johnson Wax, received the R&D Committee Technical Merit Award for 1994 for the development of a gel-reduction process for hydroxy-functional polymer production. This award is presented annually to individuals making major technical contributions to the company's R&D efforts. The award consists of a plaque and the opportunity to make a monetary contribution to technical effort meaningful to the recipient. Popli has chosen to designate his financial award of \$2,000 to MIT.

IV ARCHITECTURE

In March, Massachusetts Governor William Weld and Lieutenant Governor Paul Cellucci appointed Martha E. Ondras, MAR '74, to the state's Board of Registration of Architects. Ondras will serve a four-year term. Ondras is the founder and president of Ondras Associates Architects, Inc. (OAA), a Cambridge-based

Robert A. Laudise, PhD '56, (center) director of materials and processing research at AT&T Bell Laboratories, received the Minerals, Metals, and Materials Society's 1996 Application to Practice Award. This annual award is presented to an individual who has demonstrated outstanding achievement in transferring research results into commercial production and practical use. Laudise was honored for his pioneering studies on quartz crystallization and process optimization, which make possible commercial growth of quartz for electronic applications. He has written



over 140 publications, including The Growth of Single Crystals, a widely used text that systemizes crystal growth and provides the theoretical underpinnings. He also holds 14

patents. His other awards include the Award for Frequency Control, the Crystal Growth Prize from the American Association for Crystal Growth, and the Materials Chemistry Award from the American Chemical Society.

In addition, the International Organization for Crystal Growth renamed its practical Crystal Growth Prize the Laudise Award. He is pictured with his wife, Joyce, and son, John.

ultimately commit \$10 million in endowment to support the program. The goal is to have 60 to 80 MacVicar Faculty Fellows when the program is fully implemented. Thirty have now been appointed.

Congratulations to **Jeffrey Gray**, PhD '88, a faculty member at the Ohio Northern University College of Arts and Sciences, who recently was appointed to an endowed faculty chair. He joined the faculty in 1993. . . . **Spencer Prentiss**, SM '31, is a double bass player and cellist with the Bartlesville (Okla.) Symphony Orchestra. . . . **Maung M. Sein**, SM '61, writes: "My 32-year working career with the worldwide Tetra-Laval Group will come to an end by December 31. For the past 4 years, I have been with the group in my native country, Burma. Previously, I spent 10 years in Malaysia and 18 years in Singapore. I am VP of their Southeast Asia regional headquarters.

The Association of Alumna and Alumnae was notified that **John Thomas Massengale**, PhD '39, of West Chester, Pa., manager of R&D at FMC Corp., died on October 11, 1993. No further information was provided.



Charles Peattie

Charles Gordon Peattie, PhD '52, died in Albuquerque, N.M., on December 26, 1995, at the age of 79. A native of Beacon, N.Y., Peattie attended the New York State College for Teachers, earning an AB in chemistry in 1940. He then joined the Texas Co. (later Texaco) in Beacon, where he led the inorganic analytical

group in applying emission spectroscopy and ultraviolet and infrared spectrometry to the analysis of petroleum products. He left the Texas Co. in 1947 to attend graduate school at the University of Oklahoma, where he earned an MS in physics in 1949. Peattie then moved to the Department of Chemistry at MIT. His doctoral dissertation was entitled "Analytical Applications of the Fluorescence of Samarium in Inorganic Solids." He then worked for the Shell Development Co. in Houston, applying mass spectrometry to issues of petroleum exploration and production, before moving to Dallas with General Electrodynamics Corp. to direct research on photoconductive television-camera pickup tubes. He joined Texas Instruments in 1956 and remained there for 25 years. Peattie supervised research in electrochemistry during that time, progressing from branch manager to director of the Energy Research Laboratory of Central Research and Engineering to manager of Group Quality and Reliability Assurance in the Semiconductor Group. Peattie published papers on a variety of subjects including inorganic fluorescence, mass spectrometry, surface effects on transistors, measurement of ultrashort lifetimes by photoconductive decay, and fuel-cell technology. He moved from Dallas to Waldport, Ore., in 1985 and from there to Albuquerque, where he particularly enjoyed gardening, in 1989.

Julian Werner Hill, PhD '28, of Hockessin, Del., died on January 28, 1996. During the late 1920s, Hill was a member of a Du Pont Co. team studying the behavior of certain molecules that chain together to form larger

ones, called polymers. The chemists were engaged in pure research, though finding a substitute for silk was in the back of their minds. In 1930, while trying to create ever larger structures by adjusting the amount of water in a batch of carbon- and alcohol-based molecules, the team came up with nylon. (It would not be so named until it was introduced at the 1939 World's Fair in New York—hence, the "ny" in nylon.) "I tell my wife I was something better than a good scientist," Hill recalled in an interview years later. "I was lucky." Since Du Pont held the patents to nylon, Hill made no great fortune from the discovery. The material was deemed so important that its use was restricted to the military after the United States entered World War II. Nylon was used to make rope, tents, aircraft tires, and parachutes. The reintroduction of nylon to civilian life after the war caused a sensation. Hill was born in St. Louis and graduated from Washington University there in 1924. Hill played the violin and was an accomplished squash player and figure-skater until his early 40s, when an attack of polio weakened one leg. Before his retirement from Du Pont in 1964, Hill supervised the company's program of aid to universities for research in physics and chemistry.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Sramana Mitra, SM '95, writes: "I started India's first company addressing distributed multimedia over the Internet. We are dealing with the content and communication aspects of distributed multimedia, as well as new media databases in a client-server environment. The company, DAIS Information Technologies, has formed alliances with Pipex, a UK-based Internet service provider owned by UUNET, USA; Informix; and Videsh Sanchar Nigam Ltd., India's monopoly satellite telecom carrier. DAIS has its development center based in Calcutta, India, and offices in Boston, London, Singapore, Delhi, Bombay, Madras, and Bangalore. I also happen to be the first and only woman CEO in the Indian information technology industry." . . . **William F. Hederman, Jr.**, SM '71, writes: "I have become the executive director of the IEA International Centre for Gas Technology Information. We are supported by Canada, Denmark, Japan, Portugal, Russia, Spain, and the United States, which consumes more than half of the world's natural gas. The Centre's goal is to accelerate technology transfer in the global gas industry by using the Internet." . . . **John Tredwell**, SM '60, EE '61, reports: "I retired October 31, 1995, after 34 years of service with the federal government."

Anya Pogoyants, SM '95, and her husband, **Igor Slobodkin**, who came from Russia four years ago to earn graduate degrees at MIT and Tufts University, were killed on December 15 while on their way to a ski vacation in Lake Placid, N.Y. Born in Russia, the couple had been friends since their high school years at the School for Mathematics in Moscow. They were married by the time they began their studies in Boston in 1990. Pogoyants had received the coveted Red Diploma from Moscow State University. Friends of the Cambridge couple say she earned an MS in com-

CourseNews

puter science at Moscow State University without even touching a computer, a rare commodity in the former Soviet Union. Pogoyants made significant contributions in proving properties of randomness-containing programs. She presented her findings on computer-aided verification and distributed computing at conferences. Pogoyants filled many summer evenings by playing the guitar and singing folk songs. . . . **Marlin Claude Hydinger**, SM '50, a 40-year veteran of the U.S. Navy, died on December 11, 1995, in Arlington, Va. A native of McKees Rocks, Pa., Hydinger enlisted in the Navy in 1933 where his skills led him to a commission and a graduate degree from MIT. His career spanned 40 years of exemplary domestic and foreign service to his country. He retired with his late wife, **Helen Scott Hydinger**, to Norfolk in 1973 where he became very active in the Retired Officers Association. In 1988, they moved to Ocala, Fla.

VI-A INTERNSHIP PROGRAM

When this is published our class of new VI-A students will be experiencing their first company assignments! Director **Markus Zahn**, '67, SM '68, EE '69, ScD '70 tells me these new students are "the result of a very successful VI-A recruitment season." Eighty students were selected from amongst 161 applications (50 percent of Course VI sophomores); three are juniors (of nine who applied) and 14 are foreign students (out of 24 applicants).

This spring term the Department again conducted the EECS MasterWorks competition where selected SM, MEng, and VI-A students were invited to give oral presentations of outstanding master's thesis work. Four VI-A participants were: **Sumer S. Johal** (Analog Devices), **Jason S. Kim** (Intel Corp.), **Naimish S. Patel** (MIT Lincoln Lab), and **Sahana Sarma** (Motorola).

Via e-mail, **John F. Cooper**, '74, SM '76, wrote of his innumerable business trips to China and Mexico for Plantronics, Inc., of Santa Cruz, Calif. . . . **David W. Duehren**, '80, SM '81, attended MIT's Industrial Liaison Technology Fair program as a co-founder of the successful Brooktrout Technology, Inc., of Needham, Mass., the town where he also lives. Another founding partner of Brooktrout is VI-A'r **Patrick T. Hynes**. . . . **David S. Miller**, '81, on campus interviewing for his new company, Quantum Telecom Solutions of Highland Park, N.J., where he is chief technical officer.

I received a 7 a.m. telephone call at home from **Jay W. Van Dwingelen**, '74, of Tandem Computer in St. Louis, Mo. He was recently in New York City and hopes to get up this way come July '96 for a meeting of MIT's Educational Council. Van Dwingelen stays in contact with **Richard C. Palm, Jr.**, '74, SM '75, of San Jose, Calif., who now has five children. . . . **Hans Roland Zapp**, '63, SM '65, called from Michigan State, where he's an associate department chairman, to ask for some information for a curriculum committee on which he's serving.

A visitor from Lincoln Labs was **Vincent W. Chan**, '71, SM '71, EE '72, PhD '74, down to

the main campus on business.—John A. Tucker, director (emeritus) and lecturer, VI-A Program, MIT, 77 Mass. Ave., Rm 38-473, Cambridge, MA 02139-4307; e-mail: <jat@fenchurch.mit.edu>.

VII BIOLOGY

Norma Koch, MPH '48, of Turners Falls, Mass., died on December 1, 1995. She grew up in Los Gatos, Calif., and graduated from the College of the Pacific and the Stanford School of Nursing. Koch was a school nurse in Greenfield and in Gill for many years. She was a member of the Turners Falls Woman's Club. She spent many years as a volunteer for the American Red Cross and as a Gray Lady at the Franklin County Public Hospital, now Franklin Medical Center. She was also a volunteer for the Girl Scouts. She enjoyed outdoor activities. . . . The Association of Alumni and Alumnae was notified that **Elna Iris Perkins**, '33, of Concord, N.H., died on October 6, 1995. No further information was provided.

VIII PHYSICS

Thomas T. Wilheit, Jr., PhD '70, reports: "I'm teaching at Texas A&M and taking flying lessons." . . . **Samuel L. Park**, PhD '90, writes: "I still have a job."

Arthur M. Vash, SM '52, of Westwood, Mass., and Denmark, Maine, a partner in EPCO Packaging Co. in Framingham, died on November 13, 1995. Vash was born in Trenton, N.J. He graduated from Union College in Schenectady, N.Y., and served in the Army during WW II. He previously was VP of Damon Corp. in Needham, president of Phillips Screw Co. in Natick, and a partner in Gryphon Management Co. in Boston. Vash was a member of the board of directors of Cambridge Soundworks and OPTEX in Maryland and an overseer of the Museum of Science in Boston. A pilot, he was a former member of the Norwood Airport Association and the Aero Club of New England. . . . The Association of Alumni and Alumnae was notified that **William Albert McKinley**, PhD '47, of Altamont, N.Y., died on December 15, 1995. No further information was provided.

X CHEMICAL ENGINEERING

The Association of Alumni and Alumnae was notified that **William Ennis Skelton**, SM '32, of Nederland, Tex., died on July 20, 1995. No further information was provided.

X-A PRACTICE SCHOOL

To no one's surprise and everyone's apparent delight, Professor **T. Alan Hatton** was officially named on May 1 to the endowed Ralph Landau Professorship of Chemical Engineering Practice. The funding of the professorship by **Ralph Landau**, ScD '41, was announced in the late winter, and its award to Hatton was cele-

brated in May with a seminar presentation by Landau and a private dinner with President and Mrs. Charles Vest as hosts in the President's House. At MIT since 1983, Hatton is a native of South Africa and a graduate of the University of Natal (BS '72, MS '76) and the University of Wisconsin (PhD '81). Hatton became director of SCEP in 1989, and his enthusiasm for it remains unbounded. "After 80 years," he says, SCEP "remains a unique educational program providing a practical perspective all too often lacking in chemical engineering education."

In a cryptic note accompanying an Alumni/ae Fund gift, **Ronald G. Dunning**, SM '27, complains that "the last time I was in Cambridge I got lost on the MIT campus." That happens to lots of people, especially numerous at the time of reunions every June; we'll report on this year's returnees in the next issue. . . . **A. David Rossin**, SM '55, has just finished a one-year appointment as affiliated scholar at the Stanford Center for International Security and Arms Control. His project: research on government decisions of 1976 and 1977 that led to indefinite deferral of reprocessing of spent nuclear reactor fuel; a book is forthcoming, says Rossin. In a nutshell, he writes, the decisions were "a serious mistake."

From Lima, Peru, **Ricardo Rizo-Patron**, SM '79, writes about his 16 years' experience in that country's construction industry. Today Rizo is manager of two companies that together are responsible for 60 percent of the country's cement production—one at sea level in Lima, the other at 13,000 feet in the Peruvian Andes. Especially the last three years, he says, are characterized by strong economic development—good news for the building business. . . . By e-mail to Carol Phillips in the SCEP office, **Joel Plawsky**, SM '82, PhD '86, reports from Rensselaer Polytechnic Institute, where he's now associate professor of chemical engineering. His research interests are in interfacial phenomena, the processing of integrated optic and electro-optic devices, and the curing of concrete. He and Professor **Peter Wayner, Jr.**, SM '60, CHE, '61, are collaborating on a study of fundamental transport mechanisms governing vapor-bubble thermosyphons (heat pipes driven by capillarity, he explains); their report of this work won a best-paper award from the Japanese and American Societies of Mechanical Engineers, and they've now a NASA contract to build a thermosyphon experiment for flight aboard the space shuttle around the turn of the century, putting visions of space flight in Plawsky's and Wayner's dreams. Plawsky is married to **Gail Gamboa**, former MIT graduate admissions "goddess" (her own term, says Plawsky, to avoid using the word "secretary"), who is double-majoring in anthropology and geography as a part-time student at SUNY.

Shih-Tung Ngiam, SM '91, ScD '96, was among several SCEP alumni/ae receiving doctorates at Commencement on June 7; complete list next month. Ngiam and his wife, Susan, and daughter, Juran, left MIT soon after his successful thesis defense in April for his home in Singapore, where Ngiam expected to find work.

From **Arthur J. Power**, '42, we learn of the death on September 28, 1995, of **Charles H. Gilmour**, '31, in Charleston, W. Va. Gilmour went with Carbide and Carbon Chemical Co. in Charleston immediately after finishing the

Practice School; by 1948 he was listed as a senior design engineer, and in 1967 when he retired from what was then Union Carbide Corp. as a senior engineering consultant. Power numbers himself among "the hundreds of Carbide people who knew and loved Charlie Gilmour during Carbide's 'golden age' (1947 to about 1970), when Charlie was one of the key chemical engineers who helped achieve all the good things that happened. He designed hundreds of heat exchangers and process-heat management systems. The well-worn path to his office door was walked by hundreds from all locations and levels of the company, and he also had an international reputation as an eminent chemical engineer." Power and Gilmour worked together for the last time in 1986—a consulting job for Allis-Chalmers; writes Power, "Charlie was as energetic, personable, and brilliant as he had ever been, and the brief stint with him was a real breath of fresh air. When asked when he would really retire, Charlie said he wanted to do 'just one more job'. He had been saying that since 1967," says Power; "his heat-exchanger design work was his life."

Send news to the undersigned or to Carol Phillips in the SCEP office, MIT Room 66-309, e-mail <carol@pracschool.mit.edu>—**John Mattill**, *Technology Review*, Room W59-200, MIT

XI URBAN STUDIES AND PLANNING

John R. Kellan, MCP '42, retired in 1982 and is now involved with non-planning activities. . . . **Norma Satten**, MCP '45, of San Francisco, writes that she is "mostly retired" but occasionally consults to agency and government organizations. . . . **Irving Hand**, MCP '47, is professor emeritus of state and regional planning at Penn State and principal emeritus at Delta Development Group, Inc., in Camp Hall, Pa. . . . **Israel Stollman**, MCP '48, is involved in teaching and research in Washington, D.C. . . . **D.F. Taylor**, '50, is a project director and chair of the operations committee at the Volunteer Centre of Metro Toronto. He retired after 37 years of urban and regional planning and finds the last 11 years of volunteer work to have been very satisfying. "May all MIT alumni be as fortunate," he writes. . . . **Joseph R. Tamsky**, MCP '51, lives in Harwich, Mass. . . . **Darrel Stearns**, MCP '53, is retired and lives in Chincoteague, Va. . . . **Wesley P. Wiers**, MCP '53, runs his own business in West Sacramento, Calif., where he is an authorized agent of the Federal Housing Administration. . . . **William Butz**, MCP '56, is retired and works as a graphics technician. . . . **Peter Abeles**, MCP '48, specializes in land development at his firm of Abeles, Phillips, Preiss & Shapiro in New York City. He has been working on subdivisions in Eastern Europe. . . . **Brigitte Alexander**, MCP '58, has been the executive director of the Pittsburgh Child Guidance Foundation, which focuses on children's mental health issues, since 1982. . . . **William A. Hall**, MCP '58, is senior partner at William A. Hall Architects-Planners in New York City. He writes that architectural work is picking up and the only planning work is physical planning, but his planning background is "always useful." . . . **Richard B.**

Hayward, MCP '59, has retired and moved from Salem, Ore., to Waverly, Ohio. . . . Richard G. Townsend, MCP '59, is a professor at the University of Toronto/Ontario Institute. He has worked on several textbooks and is now conducting a study on school-home relations. . . . Libby Blank, MCP '61, is helping to offset Boston's water and sewer rates by perfecting the computer systems, meter reading, and GIS efforts of the Boston Water and Sewer Commission. . . . Bill Gomberg, '61, is looking for meaningful work in southwest Oregon and welcomes your ideas. He is a member of the Jackson County Board of Commissioners. If you do not know of a meaningful job, tell him about any job. . . . Jean MacCarthy Marshall, MCP '61, is the general planner for Southwest Harbor, Maine. She is making use of GIS mapping techniques.

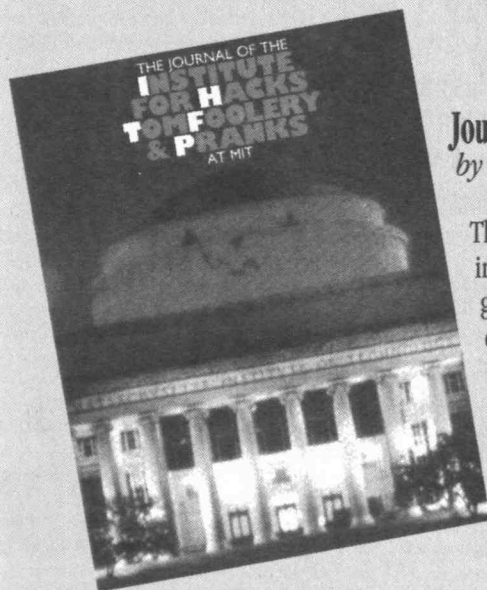
Pam Emerson, MCP '67, analyzes projects and zoning ordinances relative to coastal zones for the California Coastal Commission in Long Beach. . . . Robert Schwartz, MCP '68, has his own architecture firm in Washington, D.C., and notes under "What's new?" that "We have work." . . . Alan Rabinowitz, PhD '69, lives in Seattle. . . . Elaine Savitsky Chapman, MCP '70, recently switched fields after 15 years in banking to healthcare. However, she remains in data processing. She notes, "In my new position in a small firm (32 rather than 32,000 employees), I enjoy being able to see the impact of my activities on the company's products—and ultimately our clients. In short, I'm grateful to my previous employer for deciding to eliminate our division—it was the push I needed to make a

change I should have made long ago." . . . Parviz S. Towfighi, PhD '68, works for the United Nations in Kenya, focusing on environmental and planning research. He practices architecture as a hobby. . . . Joe Brevard, MCP '71, is president of the Planners Collaborative in Boston. The firm participates in all phases of planning efforts and is particularly known for its work in public participation and graphic communications. . . . Paulette Jones Smith, MCP '71, lives in New Orleans. She is the director of a national pilot project funded by a Congressional grant to move young parents from welfare to work and college. She notes: "After serving on the city planning commission (first black woman of this city to do so) for 14 years, I have gone from voting to cure the problems to working in the trenches." . . . James R. Warring, MCP '71, is a senior project manager at Helman, Hurley, Charvat, Peacock Architects in Maitland, Fla. Recent projects include the Biotechnology R&D Center at the University of Florida, which was dedicated in September, and a new 100,000-square-foot forensics laboratory for the Florida Department of Law Enforcement. . . . Carl V. Robart, PhD '72, is president of a division at TRA-BV Airport Consulting in Seattle. . . . Jim Wallace is at Abt Associates in Cambridge, where he manages marketing and sales activities, directs research projects, and provides international consulting services. A recent project is the development of a simulation model for testing policies on FHA-insured multi-family housing. . . . Frank Lewinberg, MCP '73, works at BLGDG, a private planning and consulting firm in Toronto.

CourseNews

From 1987 to 1992, Paul F. Levy, '74 (XI, XIV), MCP '74, ran the Massachusetts Water Resources Authority. He directed the Boston Harbor Cleanup and other parts of a multi-billion-dollar water and wastewater modernization program for the metropolitan area. Before that, he was chairman of the state's public utilities commission. He is now an adjunct professor at DUSP, teaching infrastructure planning and environmental policy. . . . Barbara Hodas, MCP '75, raises funds for Diana T. Myers and Associates, a housing developer in Glenside, Pa. . . . Con Howe, MCP '75, is director of the Los Angeles Department of City Planning, where he recently revised the city's 20-year-old general plan to emphasize development in relationship to transit, mixed-use on commercial corridors, and economic development. . . . Johnnie Jasmine Jones, MCP '75, is director of Women for Non Violent Action, a private practice in psychotherapy and training for angry and violent women. Much of her consulting was for municipal governments, but it has expanded now to private industry, too. She has also been active in Denver politics and community life. . . . Gary Hack, PhD '76, is still seen in the halls of MIT, where he teaches in DUSP. One of his recent assignments is helping the governor of Bangkok to design an urban development plan for that city. Paul Levy, '74 (XI, XIV), MCP '74, joined Hack for

Hack \ˈhak\ *n* 1: A prank, usually elaborate. *v* 1: To perform a prank. 2: To explore the places on campus that are not usually accessible. 3: To work at or study a subject not especially for academic gain.



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a few of those trips, working on water and wastewater issues. . . . **Adriana Staderker**, MCP '73, PhD '76, is managing partner at the Boston Consulting Firm in Newton, Mass., where she focuses on organizational effectiveness. She left a VP job at a *Fortune* 100 firm to help other organizations carry out effective business process re-engineering, organizational transformation, and executive development. . . . **Victor Bach**, PhD '77, is busy interpreting what is going on in Washington, D.C., as he performs policy analysis, advocacy, and lobbying for the Community Service Society in New York. . . . **Alan Bell**, MCP '78, is a principal of a New York City real estate development company, The Hudson Companies, Inc. The firm concentrates on residential development and is one of the largest developers of affordable home ownership housing. He writes, "To the dismay of some rock-and-roll fans of my generation, we recently completed the demolition of the former Fillmore East Theatre. In its place will rise the Fillmore East Apartments with 86 apartments. Eighty percent of the units will rent at the market rate and 20 percent will be reserved for low-income tenants." . . . **Susan Brody**, MCP '77, just started a new job at the Lane Council of Governments in Oregon, where she will work on policy analysis, land use planning, and transportation planning. . . . **Stephen Klein**, MCP '77, is the CFO for the Vermont state legislature and focuses on budget and tax policy issues.

Charles Kubat, MCP '77, manages all long-range and current planning and design efforts for the development of a 23,000-acre new community in Las Vegas. He writes, "After spending

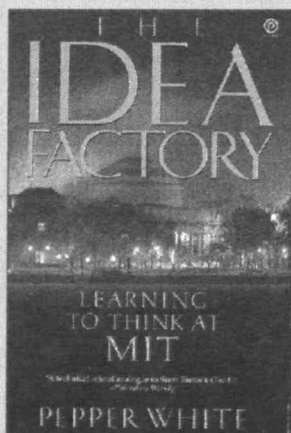
the last four memorable years in Houston directing the design and planning efforts of Friendswood Development Co. (a subsidiary of Exxon) on its large planned communities creating pedestrian-friendly town centers and neighborhoods, I have accepted an offer from the Howard Hughes Corp. to become their VP for planning and design of Summerlin, America's fastest-growing planned community. In three weeks we organized a family move from Houston to Las Vegas and are actively enjoying our new desert climate." . . . **Vivian Li** (non-degree program) heads up the Boston Harbor Association, a well-respected advocacy group that promotes a clean, accessible, and alive Boston Harbor. Vivian recently helped advise current MCP students on career planning. . . . **Francis J. Mendez Rigau**, MCP '77, is president of Mendez England & Associates in San Juan. The firm provides management consulting, technical assistance, and training and has contracts in the former Soviet Union, Egypt, and Latin America. . . . **Thomas J. Nally**, MAA '77 (IV), MCP '77, is planning director for the Artery Business Committee, which represents the interests of the business community with the city of Boston and the state on the Central Artery/Third Harbor Tunnel project. He was also asked by the Brookline Board of Selectmen to serve as co-chair of the town's economic development advisory board. The economic development board promoted appropriate development in Brookline that enhances the town's environment and supports existing commercial areas. . . . **Philip Shapira**, MCP '79, researches and teaches economic development planning, technology policy, and regional devel-

opment at the School of Public Policy at Georgia Tech. He is editor of a new book, *The R&D Workers* (Quorum Books, 1995) and is co-director of a new project on restructuring, privatization, and democratization in Bulgaria. . . . **Robert Bluhm**, MCP '78, is project manager for all phases of building and remodeling projects at UC/Berkeley. Projects range in cost from \$500,000 to \$50 million and cover planning, design, and construction. . . . **Kirk Emerson**, MCP '78, is a doctoral candidate at Indiana University's School of Public and Environmental Affairs. She finished three years of coursework and comprehensive exams and is working on her dissertation from Tucson, where her husband teaches at the University of Arizona. . . . **Dean Johnson**, MCP '78, writes, "I work for people who pay me." He manages real estate and also consults on acoustical audiovisual systems design and environmental projects, especially those associated with development impacts. He also is a VP of the Boston Area Youth Soccer League, where he and **Paul Levy**, '74 (XI, XIV), MCP '74, help organize games for the boys and girls of the metropolitan area.

XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

George H. Beall, PhD '62, a research fellow at Corning, Inc., delivered the Edward Orton Jr. Memorial Lecture at the American Ceramic Society's (ACS) 98th annual meeting on April 15 in Indianapolis, Ind. His talk, entitled "Innovation in Multiphase Glass-Derived Sys-

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tems," was presented to approximately 1,000 ACS members. Beall joined Corning in 1962 as a research geologist/mineralogist in the R&D division. He became manager of the



George Beall

glass-ceramic research department in 1966 and was appointed research fellow in 1977, the first scientist appointed to this senior technical position. Beall is credited with the discovery of glass-ceramic materials used in such products as Macor® machinable glass-ceramics, which have widespread use in

the electronic, aerospace, and other industries, and the glass-ceramic used in institutional tableware as well as the cups used in Corelle® retail line. He was also involved in the development of Visions cookware. He holds more than 75 patents and is the recipient of the prestigious John Jeppson Award for his work leading to the creation of transparent glass-ceramics, strong glass-ceramic tableware, and machinable glass-ceramics. Beall holds a BS in physics and an MS in geology from McGill University. . . . Pam Melroy, SM '84, recently completed the initial phase of pilot astronaut training at NASA. (She is the second woman to be trained by NASA in this capacity.) She is to be assigned to a space shuttle mission that will occur in the next two to three years. In the interim, she will continue to train and fly in a plane configured to simulate the space shuttle. She is also involved in promoting NASA and its program to the general public.

XIII

OCEAN ENGINEERING

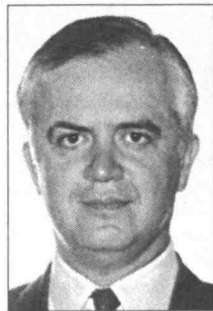
Robert G. Walsh, Jr., SM '68, reports: "I established Global Marketing & Trading, Inc., (GMT) in 1994. GMT is now fully operational in providing Chinese-manufactured marine machinery and equipment to commercial shipyards worldwide and is able to provide stern-append, hydrodynamic, energy-saving devices that are cost-beneficial for new buildings and retrofits. Contact GMT at <duje53a@prodigy.com>." . . . Captain Robert B. Cook, Jr., SM '77, OCE '77, writes: "After serving as the director of advanced submarine R&D, I've assumed the duties of program manager of the AN/BSY-2 Submarine Combat System, the Navy's most advanced submarine combat system for the SEAWOLF class submarines." . . . Harry E. Davis, Jr., SM '42, of Washington, D.C., writes: "I am fully retired, but in good health at 86 years."

XIV

ECONOMICS

The McGraw-Hill Companies, Inc., named Pedro Aspe, PhD '78, to its board of directors. Aspe, a global authority on economic issues and public finance, served as Mexico's secretary of finance and public credit from 1988 to

1994, and as secretary of programming and budget from 1987 to 1988. Aspe also will serve on the audit committee of the McGraw-Hill Companies' board. Aspe is chairman of Vector Casa de Bolsa, S.A. de C.V., Grupo Pulsar. Since 1995, Aspe has taught economics and finance at the Instituto Tecnológico Autónomo de México in Mexico City, where he obtained a BA in 1974 and then attended MIT as a Fulbright Scholar. As Mexico's secretary of finance and public credit, Aspe oversaw and supervised Latin America's largest public-sector privatization, as 283 state-run entities in industries ranging from banking to steel and telecommunications with \$26.2 billion in combined annual revenues, were transformed into private companies. For over five years, Aspe and his team developed successful privatization models for these companies, effectively becoming their CEO responsible for labor, pricing, and organizational issues during the transition period. He turned a public financing operations with a 10 percent deficit into a successful project with an operating surplus, streamlining the finance and public credit department into one of Mexico's most efficient agencies during the presidency of Carlos Salinas de Gortari. During this period and thereafter, he also served as counselor and advisor on privatization to several other Latin American governments. Aspe also contributed significantly to Mexican debt negotiations with the United States during the Bush and Clinton administrations, and provided early guidance and support leading to the signing of the North American Free Trade Agreement (NAFTA). Aspe entered Mexico's public service in 1978, taking on a number of staff positions in the Department of Finance with increasing levels of responsibility through 1982. In 1982 and 1983, during the de la Madrid government, he created and oversaw the department's new National Institute for Statistics, which provides data for planning growth and development. Aspe then served as undersecretary of planning and budgetary control until 1987, when he was promoted to secretary of programming and the budget. Aspe was named the Lionel Robins Lecturer at the London School of Economics and also serves as a member of the MIT Corporation. He is a member of the board of Stanford University's Institute of International Studies, as well as of several not-for-profit organizations in Mexico, and he serves on the board of the Claremont Graduate School in California. Aspe was born in Mexico City, where he currently resides with his wife and four children.



Pedro Aspe

Peter Temin, PhD '64, the Elisha Gray II Professor of Economics at MIT, has been elected president of the Economic History Association for 1996-97, and will give the presidential address at the association's annual meeting in September. The Economic History Association was founded in 1940 to encourage and promote teaching, research, and publications on every phase of economic history, and to encourage and assist in the preservation and administration of materials for research in economic history.

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CourseNews

XV

MANAGEMENT



Edward Filusch

Colgate-Palmolive promoted Edward Filusch, SM '75, to VP and assistant treasurer. Filusch will be responsible for the corporation's risk management and insurance functions, pension and other benefit-plan financing, as well as treasury operations in the United States and Asia/Pacific. Filusch joined Colgate in

1982 as associate director of strategic planning. In 1987, he moved to the treasury department as an assistant treasurer in charge of domestic treasury operations. Since then, his experience has touched nearly all treasury functions, including pension and savings plan investments, financing transactions, international treasury operations and foreign exchange management. Filusch is a native of Cincinnati and now resides in Lincroft, N.J. He received a BS in engineering science from the University of Notre Dame and an MS in electrical engineering from Princeton University. Colgate-Palmolive is a leading global consumer-products company, focusing on the core business of oral care, personal care, household surface care, fabric care, and pet dietary care. . . . Gerry Licea, SM '89, writes: "I currently work for the Trade Commission of Mexico (Bancomext) as an investment executive in downtown Chicago. We are comparable in function to the U.S. Export-Import Bank in Washington. I participate in activities sponsored by the MIT Club of Chicago with pleasure." . . . Sandoz Pharmaceuticals promoted Heidi Sykes-Gomez, '83, SM '85, to the position of director of new product management for the transplant business sector. She began her career at Sandoz in 1985 as a sales representative in New Jersey and New York, and was later promoted to positions in market research, corporate acquisitions, and immunology/oncology new product management. Since 1991, she has held product management positions heading Clozaril in schizophrenia, and Sandimmune and Neoral in transplantation. She received Sandoz' Marketing Excellence Award in 1992, and the Outstanding Achievement in Marketing Planning award in 1987. Originally from Poughkeepsie, N.Y., she resides in Summit, N.J., with her husband and infant twins.

David Durand of Lexington, Mass., a professor emeritus of management at MIT, died February 26 following a lengthy illness. He was 83. Raised in Ithaca, N.Y., Durand received a bachelor's degree from Cornell University in 1934 and an MS in 1938 and a PhD in 1941 from Columbia University. Durand was a WWII Naval Reserve veteran, serving in the Hawaiian islands and on Guam. Before

coming to MIT in 1953, he was associated with the National Bureau of Economic Research, then in Riverdale, N.Y., and the Institute for Advanced Study at Princeton University. He also did consulting work for the Twentieth Century Fund and taught part time at Columbia University. His first appointment at MIT was as research associate at the Sloan School. He became a full professor in 1958, and retired in 1973. Durand was the author of the textbook *Stable Chaos*, as well as numerous articles for professional journals. He was also an associate editor of *Financial Management* for many years. He was a member of the American Economic Association, the Finance Association, the American Society for Quality Control, the American Statistical Association, the Econometric Society, the Biometric Society, the Institute of Mathematical Statistics, and the International Association for Statistics in Physical Science.

SENIOR EXECUTIVES

Frank Herbert Barker-Benfield, '63, of Bucks, England, died on August 3, 1995. He attended Wellington College in Berkshire and Trinity College in Cambridge. From 1939 to 1943, he served in the Royal Engineers in East Africa and attained the rank of captain in charge of a field company in Kenya. In 1944, he joined the provincial administration of the Government of Tanganyika Territory (now Tanzania) as an assistant district officer. He then joined East African Power & Lighting Co. and was stationed at Tanga. Later, he joined Tanganyika Packing Co. at Dar-es-Salaam. Returning to Britain in 1951, he joined Urwick, Orr & Partners as a management consultant. He undertook various assignments in Britain and overseas. For four years, he served as director of studies at the Urwick Management Training Center. On retirement as a principal senior consultant in 1976, Barker-Benfield started work with the Euro-Japanese Exchange Foundation as a business studies tutor. He also assumed responsibility for the foundation's library. Retiring from full-time work in 1983, he began part-time voluntary work for the Building Conservation Trust and the Care of Buildings Exhibition at Hampton Court Palace as librarian and honorary accountant. He also recorded books and papers for the blind and visually handicapped.

The Association of Alumni and Alumnae was notified that **Leon K. Kirchmayer**, '75, of Rexford, N.Y., who retired from General Electric Co., died on November 12, 1995. No further information was provided.

MANAGEMENT OF TECHNOLOGY

Steve Siegel, SM '91, is now the manager of Internet Server Solutions for Compaq Computer Corp. Siegel and his family met with **Luis Rendon**, SM '91, and his wife, Adriana, for a brief reunion in Houston, Tex. . . . **Brian Fees**, SM '93, has returned to Boston. He is the manager of corporate finance in the financial advisory services division of Coopers & Lybrand. . . . **Max Michaels**, SM '95, recently participated in the McKinsey Practice Olympics in Bermuda, where his team was declared the worldwide winner for their presentation entitled "Managing Growth Options," which was based on Max's MIT thesis.—MOT Program, MIT, Room E52-126, Cambridge, MA 02139; e-mail: <mitmot@sloan.mit.edu>

XVI AERONAUTICS AND ASTRONAUTICS

Fabien Fedida, SM '94, of Brookline, Mass., writes: "As a transportation consultant at Caliper Corp., I specialize in routing and logistics including site selection, vehicle routing, and districting."

The Association of Alumni and Alumnae was notified that **Boyd Bertrand Brainard**, SM '31, of Sun City, Ariz., who retired from Kansas State University, died on October 19, 1995. No further information was provided.

XVIII MATHEMATICS

Richard B. Lavine, PhD '65, writes: "I've been in the math department at the University of Rochester for almost 25 years. A new administration has recently decided to drop our graduate program and let the department shrink by half. The March *Notices* of the AMS has a report on this and the massive reaction from the scientific community, including several from MIT. Maintaining strength in science without a strong math department seems unlikely."

Gustave Solomon, PhD '56, a mathematician whose work was important in the world of digital information, died on January 31 at his home in Beverly Hills, Calif. He was 65 and had lived in the Los Angeles area since 1961. Solomon was a coinventor, with Irving S. Reed, of what are known as the Reed-Solomon codes. They are used to purge errors from digital information in data storage and communications systems. The codes were invented in 1960, when both men were working at Lincoln Laboratory. Solomon spent much of his career in research laboratories. He was a senior scientist with the Hughes Aircraft Company in California from 1987 until retiring several years ago. Solomon and H.F. Mattson, now on the faculty of Syracuse University, were the co-authors of a 1961 article in a mathematical journal that introduced what has been called a powerful tool for analyzing error-correcting codes and is known as the Mattson-Solomon polynomial. Solomon remained active in research about coding from 1957 until his death. His other interests included composing popular songs and folksongs and teaching voice and movement. Solomon was born in Brooklyn and graduated from Talmudical Academy High School of Manhattan. He went on to receive a BS in mathematics from Yeshiva University in 1951. He taught mathematics at Boston University and Johns Hopkins in the late 1950s and was on the staff of the Lincoln Lab from 1957 to 1961. In later years he also worked at the Jet Propulsion Laboratory (JPL) and TRW Systems, both in the Los Angeles area. Over the years, he was also a visiting or adjunct professor at UC/Berkeley, UCLA, and CalTech. He was a consultant to JPL from 1990 to 1995.

XX APPLIED BIOLOGICAL SCIENCES

A lectureship in honor of Professor **Bernard E. Proctor** has been established within the food engineering division of the Institute of Food

Technologists. Contributions from Proctor's former students are welcome for this lectureship and may be sent to: Mike Sinoskas, Institute of Food Technologists, 221 N. LaSalle St., Chicago, IL 60601. Proctor is remembered as a professional who spent his entire life at the Institute and who passed away when he was head of the Department of Food Technology.

XXII NUCLEAR ENGINEERING

Daniel R. Raichel, SM '58, a resident of Wyckoff, N.J., and director of acoustics at Cooper Union in New York City, has been named a Fellow of the American Society of Mechanical Engineers. The Fellow grade is conferred upon a member with at least 10 years active engineering practice who has made significant contributions to the field. Raichel holds degrees from New York University, Columbia University, and the Rensselaer Polytechnic Institute. He is also a member of the Acoustical Society of America, the American Physical Society, the Audio Engineering Society, the New York Academy of Sciences, the American Society for Engineering Education, Tau Beta Pi, Sigma Xi, and Pi Tau Sigma.



Frederick Buckman

Frederick W. Buckman, PhD '70, president and CEO of PacificCorp since 1994, was elected to the board of directors of Standard Insurance Co. He previously served as president and CEO of Consumers Power in Michigan. Buckman is a graduate of the University of Michigan and attended Harvard Business

School's Advanced Management Program. He is chair of the boards of Oregon Health Science University and Nike World Masters Games. Buckman also serves as a director of the Oregon Museum of Science and Industry, Portland School District Foundation, Oregon Independent College Foundation, Portland Chamber of Commerce, Association of Edison Illuminating Companies, and Edison Electric Institute. . . . **Gilbert Brown**, SM '72, NUE '72, PhD '74, was recently named an assistant to the dean of the college of engineering at UMass/Lowell. Brown, a professor in the Department of Chemical Engineering, will work with the dean on student affairs, outreach, academic affairs, and research. The appointment, which will necessitate a reduction in Brown's teaching load, is part of a restructuring of the College of Engineering. With some 100 faculty members, 1,000 undergraduates, and more than 700 graduate students, the College of Engineering represents a large piece of the University's ongoing activity.

TPP TECHNOLOGY AND POLICY PROGRAM

Adam Jaffe, '76 (V), SM '78, is a tenured professor at Brandeis University. . . . Now in Everett, Wash., **Clinton Stanovsky**, SM '81, is the sole proprietor of a consulting firm bear-

Lifetime Education in Action

By
JAMES SHANNON

When I opted to enroll at MIT some 20 years after I completed my bachelor's degree at Johns Hopkins, my friends were bemused. They consider me—accurately—one of the least technical people in America. But my decision actually made a lot of sense.

Like many people in mid-career, I experienced moments of wishing that I had put a slightly different emphasis on my education when I had the chance. There have also been occasions when I would have benefited, both personally and professionally, from the opportunity to examine important issues with more depth and discipline than time allows when dealing with the immediate problems of government or business.

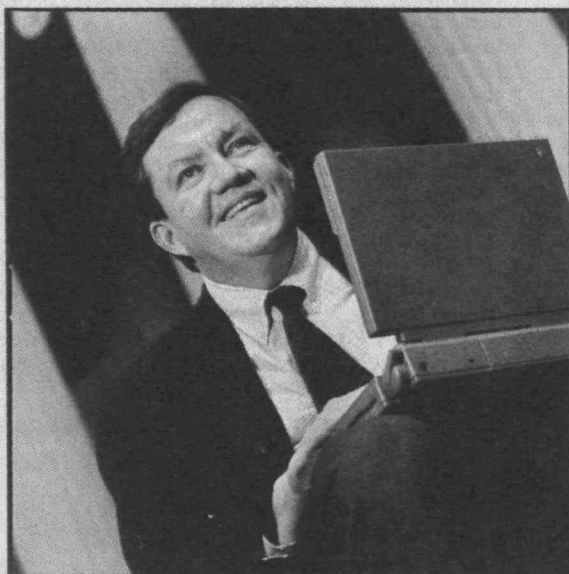
For years, I thought about returning to school, not to pursue a degree, but to study in areas where my career has drawn me. When I decided to act on that impulse and enroll, I thought about the MIT faculty members and graduate students I had known—experts in Soviet studies, arms control, and Latin America. I thought about working with the late Les Aspin, PhD '66, a congressional colleague who had received a doctorate from MIT's Department of Economics. All these people had a command of their subjects that impressed me and made me realize that MIT was not just a place for scientists.

I also thought that if I was going to do this at all, I should do it seriously, and no one has ever questioned whether MIT is a serious academic institution.

So I enrolled in September 1995 in Professor Loren Graham's course in the Social and Political Evolution of Russia, even though it had been years since I had spent any time studying that part of the world as a member of Congress. Actually, as a first step back into the academic world, I found the course attractive precisely because I was not currently work-

ing in the area. This was going to take real time and effort; since it appeared that there would be no immediate return, my commitment to pursuing knowledge, as opposed to some career objective, would be put to the test.

One of my greatest concerns was whether I could handle the logistics of being a student again. The course met in the evening, so getting to class most weeks would not pose a problem. But I



Jim Shannon relied on his laptop computer and e-mail to keep up with his class.

would be taking several trips during the semester, and I was worried that unavoidable conflicts would interfere with my full participation in the class.

As it turned out, I had to make half a dozen trips around the country and one to Europe during the fall term, but none prevented me from getting to class. E-mail made it possible for me to submit writing assignments on time, even when I was out of town. And by buying copies of the supplementary readings, I cut down on trips to the library. Logistics was not a problem.

More importantly, the intellectual

experience was exactly what I had hoped for. If the course had been just a close look at a dramatic and enigmatic historical period that was of profound importance to our country, it would have been well worthwhile. But it was considerably more than that. It got me to take a fresh look at how the mix of history, economics, politics, and technology determines the shape of the contemporary world.

As a lawyer, a person involved in business, or a politician dealing with a foreign country, one tends to bring that single perspective to any given problem. Under Professor Graham's tutelage, we were reminded how important it is to look at issues from a broader perspective. Did the Soviet Union collapse because of ideology, economics, or nationalism? Clearly, it was a combination of all three, and not to consider them all could only lead to a distorted view of what is unfolding there at present.

Studying at MIT provided the additional benefit of throwing me in with exceptionally bright students who brought truly unique perspectives to the discussions. (Where else, for example, would you find a fellow student who had already spent a great deal of time studying the history of the Soviet space program?) And they were extremely indulgent about having an "old guy" crash their seminar.

As it turned out, there was an unexpected payback on my investment of time and energy. In January, I was invited to the Republic of Georgia to participate in a program to help set up the new parliament. There is no question that when I was in Tbilisi, it was enormously useful to have spent the previous three months studying the whole Soviet experience. But that benefit was incidental to what I really took away from my term at MIT: the chance to stop and take a closer look at how the world in which I live and work is going to change. □

JAMES SHANNON is vice-president and general counsel of the National Fire Protection Association. When he was elected to the first of his three terms in the House of Representatives in 1978, representing Massachusetts's 5th district, he was the youngest member of Congress. From 1987 to 1991 he served as the state's attorney general. Shannon just finished his second course at MIT.

ing his name. His principal client is ASARCO. He is also president of Campaign Geographics, Inc., a start-up firm providing computer-based mapping of election data and other related information on local politics. . . . **Laurence Zwimpfer**, SM '81, is the business futures manager at Telecom New Zealand. The company's major shareholders are Bell Atlantic and Ameritech. . . . **David Cheney**, SM '83, is at the U.S. Department of Energy, where he is the executive director of the energy advisory board and a special assistant to the energy secretary. . . . **Matthew Buresch**, SM '85, took a leave of absence from Hagler Bailly in Washington, D.C., for a two-year assignment as professor of business strategy at the American University in Bulgaria. . . . **Richard Byrnes**, SM '89, transferred from the transportation consulting team to the operations management group at Booz Allen & Hamilton and has shifted his focus to manufacturing clients. Also, he and his wife, Sara, were expecting their first child in May. . . . **Peter Cunniffe**, SM '90 (XVI, TPP), is a senior staff member in the economic and decision analysis center of the MITRE Corp. . . . **Hagette and M.B. "Tunde" Fafunwa**, SM '92, are very pleased to announce the arrival of their third child (and first son), Dele, on January 15. . . . In September 1995, **Robert Margolis**, SM '92 (XV, TPP), began his doctoral studies in the Science, Technology and Public Policy Program at Princeton University's Woodrow Wilson School. Margolis says the classes have been interesting and he is getting involved in research on renewable energy systems. He is conducting field work on photovoltaics in South Africa this summer. . . . **James Ellison**, SM '96 (II, XVII, TPP), is an associate at Hagler Bailly Consulting, Inc. . . .

Jonathan Kleinman, SM '96 (I, TPP), has joined the staff of Vanasse Hangen Brustlin, Inc., as a planner in the urban planning department and is working on issues of environmental impact statements for Logan Airport. . . . Congratulations to **Edward Mierzejewski**, SM '71 (I), TPP Friend, successfully defended his dissertation, "An Assessment of Uncertainty and Bias: Recommended Modifications to the Urban Transportation Planning Process."—Richard de Neufville, TPP, MIT Room E40-252, Cambridge, MA 02139; e-mail: <ttp@mit.edu>

Deceased

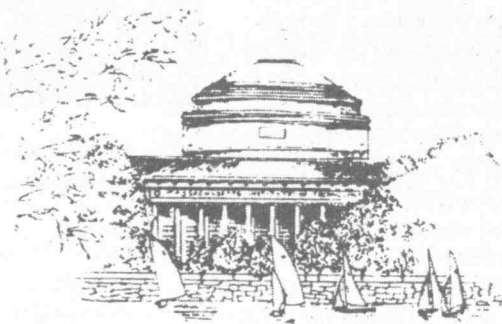
The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

Myer Harry Naigles, '21; September 25, 1995; Yonkers, N.Y.
Roger Cutting, '23; July 24, 1993; Pasadena, Calif.
Gates Wilson Burrows, '25; May 8, 1995; Columbus, Ohio
George Elliston Brennan, '30; July 27, 1987; Saint James, N.Y.
Eric Axel Ericson, '32; October 9, 1995; Plainville, Conn.
Gertrud Elvira Ebbeson, '33; August 22, 1988; Bangor, Maine
Julian Joel Klein, '33; December 10, 1995; Newton Center, Mass.
William Walker Bartlett, '34, SM '35; November 28, 1995; Harvard, Mass.
Frank Anthony Faillace, '34, MAR '37; March 26, 1988; Delray Beach, Fla.
Allan Quimby Mowatt, '35; March 20, 1996; Valley Center, Calif.

Robert Austin Fairbairn, '39; September 16, 1995; Monument Beach, Mass.
Pun Lien Koh, ScD '39; December 6, 1994; Lubbock, Tex.
Melvin Leslie Jackson, SM '40; October 19, 1994; West Redding, Conn.
Clifford Hitchcock Hahn, '41; April 8, 1995; North Reading, Mass.
John Clark Collins, SM '42; November 26, 1995; Medford, Ore.
Donald Loren Wrisley, '45; August 29, 1995; Lady Lake, Fla.
Winthrop Edward Sullivan, '46; February 25, 1994; Madison, Ala.
Phillip Solomon, '47; September 18, 1995; N. Bay Village, Fla.
Robert Vincent McCarthy, '48; March 11, 1994; Westwood, Mass.
John Albert Wolfe, '48; January 30, 1996; Burlington, Mass.
Edward Henry Mueller, '49; April 26, 1995; Fair Lawn, N.J.
Walter Joseph Mordarski, '49; November 16, 1995; Wallingford, Conn.
Thomas Francis Dell, '51; November 11, 1994; Aurora, Colo.
Philip George Eckert, SM '53; January 21, 1996; Lake Wylie, S.C.
Robert Leonard Rhodes, SM '54; February 4, 1995; Saint Paul, Minn.
Lawrence Philip Hallee, '56; August 19, 1994; Acton, Mass.
Alden W. Kilborn, '58; June 19, 1994; Palm Desert, Calif.
Theodore Elliott Kupfrian, SM '65; November 3, 1995; Bedford, Mass.
Kevin Rung-San Chen, ScD '72; May 1, 1995; Everett, Mass.
Vernard A. Lanphier, '76; March 13, 1993; Washington, D.C.



HERE MIGHT A NAME BEST LIVE?



The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues and family. Memorial gifts can be unrestricted or directed toward scholarships, research or any program of the Institute. The Institute notifies bereaved families of the name of each donor, and each gift becomes a part of MIT's permanent record.

Named endowed funds whose income supports the work of the Institute in perpetuity can be established with larger gifts. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617) 253-8059.

PuzzleCorner

This next academic year will be unusual for me. For the first time since 1963, when I went off to MIT as an undergraduate, I will not be primarily at a university. Instead, I will be on leave from NYU in order to spend the year at NEC research. My NYU e-mail and U.S. mail addresses will still work, but you can also reach me at <gottlieb@research.nj.nec.com> and NEC Research Institute, 4 Independence Way, Princeton NJ 08540.

Problems

A/S 1. On a recent visit to the bridge club, Larry Kells took his seat kibitzing at his customary table and heard the following auction:

S	W	N	E
1D	2D	3D	4D
5D	6D	7D	Db1*
P	P	P	

*After having found out he could not bid 8D!

Looking at the hands afterwards, it was clear that every bid was reasonable, and the contract was the best that could be reached if both sides bid optimally. Can you reconstruct the deal?

A/S 2. George Blondin wants to know the smallest integer whose product when multiplied by 9 is the original number with the rightmost digit rotated all the way to the left.

$$\begin{array}{r} abc...lmn \\ \times 9 \\ \hline nabc...lm \end{array}$$

The use of the letters from a to n was just for convenience and the fact that n is the 14th letter does not imply that the answer has 14 digits.

A/S 3. Leonard Nissim is a fan of nine-digit numbers that contain each of the nine positive digits exactly once



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO: ALLAN GOTTLIEB, '67
NEW YORK UNIVERSITY
715 BROADWAY, 10TH FLOOR
NEW YORK, NY 10012,
OR TO: <GOTTLIEB@NYU.EDU>

(there are nine factorial such numbers). How many of these numbers are divisible by 11?

Speed Department

Jon Sass has some more quickies where each capital letter represents a word beginning with that letter. For example, the answer to the first problem below is 16 ounces in a pound.

16 O in a P
90 D in a R A
1 W on a U
5 D in a Z C
11 P on a F T
1,000 W that a P is W
29 D in F in a L Y
64 S on a C
40 D and N of the G F

Solutions

Apr 1. We start with a bridge problem from Doug Van Patter:

	North
♠	K J 10 4
♥	K Q 6 5 2
♦	A Q 8
♣	4
	South
♠	A Q 9 3
♥	7 4
♦	7
♣	A K Q 9 7 6

South dealt and the bidding went as follows with East-West silent: 1C 1S 4NT 5D 6S. What is South's best line of play?

The following solution is from Thomas Hariman.

The toughest opening lead is a diamond. Since finessing for the king would present a 50 percent chance of being set immediately on the obvious return lead of a heart, dummy must play the ace. Anticipating a 4-1 trump split, lead the spade 3 to the ace and then lead a small heart toward the king.

If West has the ace but holds off, the king wins. The spade king exposes the bad trump split, but the club ace followed by a club ruff high should set up the clubs: pull trump and run clubs for 12 tricks.

If West grabs the ace and leads a diamond to force declarer to ruff, a small heart to the king followed by a heart ruff high establishes the 12th trick: pull trump, take the heart queen, then three top clubs.

When East holds the heart ace, best defense is to take the king and lead a diamond to force

a ruff. Declarer leads to the heart queen, next ruffs a heart high, and pulls trump. If hearts broke 3-3, dummy leads two good hearts and declarer takes the rest with high clubs. Otherwise he plays top clubs to win if they break 3-3. This should win about 2/3 of the time.

If the first trump lead shows a 5-0 split, declarer survives with some distributional luck. Again lead a low heart: if the holder of the ace is void of trump and declarer can guess the distribution, he can take topplers and cross-ruff, opponents' five spaces falling under higher ones.

The danger in not pulling trump right away is of course a heart ruff when the ace is opposite a singleton, about a 1/6 chance (even less: if West had a singleton, he would love to lead it). But a 4-1 trump split probability is about twice that.

Apr 2. Ermanno Signorelli wonders if there is a right triangle with integer sides such that both legs are odd integers.

Robert Barnes shows us that no such triangle exists.

Supposing that there is a right triangle with all sides integers, the legs being odd, this gives:

$$\begin{aligned} (2m+1)^2 + (2n+1)^2 &= r^2, \text{ so} \\ (4m^2+4m+1) + (4n^2+4n+1) &= r^2, \text{ so} \\ 4(m^2+n^2) + 4(m+n) + 2 &= r^2. \end{aligned}$$

LHS is obviously even, so RHS is even; since r^2 is even, so is r .

$$\begin{aligned} 4(m^2+n^2) + 4(m+n) + 2 &= (2k)^2 = 4k^2, \text{ so} \\ 2(m^2+n^2) + 2(m+n) + 1 &= 2k^2. \end{aligned}$$

But now LHS is odd, and RHS is even.

Hence, there is no such triangle.

Apr 3. An illuminating question from Chuck Livingston

Lamp posts are to be installed on the equator of a perfectly spherical planet in such a way that they illuminate the entire equator. A few very tall lamps could be used—three is the minimum—or many short lamps. In what way should this be done so that the total height of the posts is as small as possible.

Mike Gennert notes that infinitely many infinitesimally small lamps can bring the total height down to zero.

Let the planet have radius 1. If there are N lamps, each lamp must illuminate $2\pi/N$ of the equator. A right triangle going from the lamp to the center of the earth to the edge of the region illuminated by that lamp has hypotenuse $1+H$, where H is the lamp post height, and angle π/N at the center of the earth. Therefore $(1+H)\cos(\pi/N)=1$ so $H=(\cos(\pi/N))^{-1}-1$. The total height of all lamp posts is just $T=NH$. T is a monotonically decreasing function of N , approaching zero (using l'Hôpital's rule) as N goes to infinity. This can be checked by computing the derivative of T w.r.t. N .

$$\frac{dT}{dN} = \frac{1}{\cos(\pi/N)} - 1 - \frac{\pi \sin(\pi/N)}{N \cos^2(\pi/2N)}$$

Also, as N gets large, T behaves as $\pi^2/2N$.

Continued on Page MIT 35

MIT LIFE INCOME FUNDS

MRS. LOUIS K. FRANK

HOME: Chestnut Hill, Massachusetts

CAREER: Mrs. Frank's husband, Lou, grew up in Roxbury, Massachusetts. Accepted into the Class of 1934 on full scholarship, he took two trolley rides to get to MIT. In 1941, with a degree in aeronautical engineering, he joined the US Army Air Force Material Command at Wright Field in Dayton and held the rank of colonel at the conclusion of his service. After the war, he returned to Boston and set up an advertising agency that specialized in high-tech companies. He sold the agency in 1974 and became involved in mergers and acquisitions. A devoted family man, an outstanding golfer and proud alumnus of MIT, he was an active volunteer for the Class of 1934. He died in 1990.

Married to Mr. Frank in 1956, Mrs. Frank decided to go back to school in 1968. With her husband's encouragement and support, she earned a bachelor's degree *magna cum laude* and master's degree in social work from Boston University, and began working as the director of social services in Boston-area nursing homes. Now, she serves as a geriatric consultant.

MIT LIFE INCOME FUND: The Frances G. Frank Gift Annuity Fund.

QUOTE: Lou used to say that he was just lucky, and I guess I can say I was lucky too, being married to a truly great and good man for 34 years. I have a deep and abiding feeling of gratitude not only toward Lou, but also toward MIT for what it gave my husband and me. And that is why I want to give to MIT—to thank the Institute for both of us.

For more information about MIT Life Income Funds, write or call D. Hugh Darden or Frank H. McGrory at MIT, Room 4-234, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

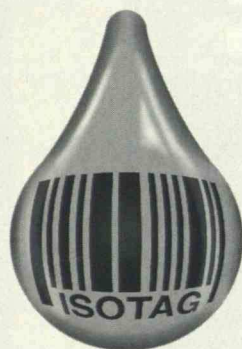
Photo: Richard Howard



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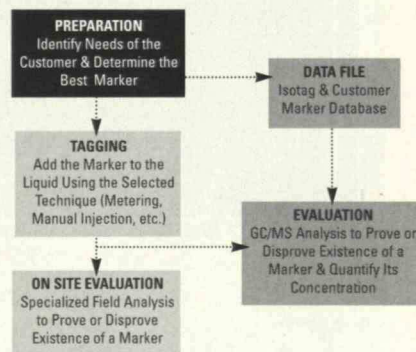
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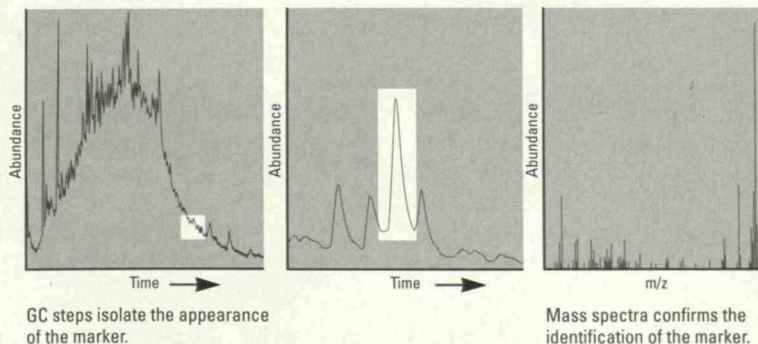
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Responsive SCULPTURE

BY DENNIS NORMILE

Intent on using technology to enhance people's awareness of their surroundings, a mechanical engineer turned artist has created prize-winning pieces of art that react to their environment.

At the entrance to a mammoth high-rise housing project hard by the Sumida River, a mile or so from Tokyo's famed Ginza shopping and entertainment area, stands a monumental sculpture that doubles as sort of a weather station and neighborhood activity center. A "U" of stainless steel, festooned with two elliptical paddles, balances atop a thin 26-foot-high, three-legged arch of red granite. Low-friction bear-





THE THREE WINGS IN KIYOYUKI KIKUTAKE'S WORK, "THE SKY," CHANGE POSITION
ACCORDING TO VARIATIONS IN WIND DIRECTION AND SPEED.



A



B

ings at the bottom of the U ensure that the slightest breeze sets it and the paddles in motion, back and forth, according to how the wind is blowing. When the sun is out, those movements scatter reflected beams over the buildings and plaza.

The sculpture also indicates the strength of the wind. A nearby sensor feeds information on wind speed to a microcontroller that runs a pump in the base of the sculpture. This, in turn, sends water through pipes up each of the sculpture's granite legs. Just how far the water rises before exiting through any of a series of spouts and then trickling down the exterior of the legs depends on how forcefully the wind is blowing.

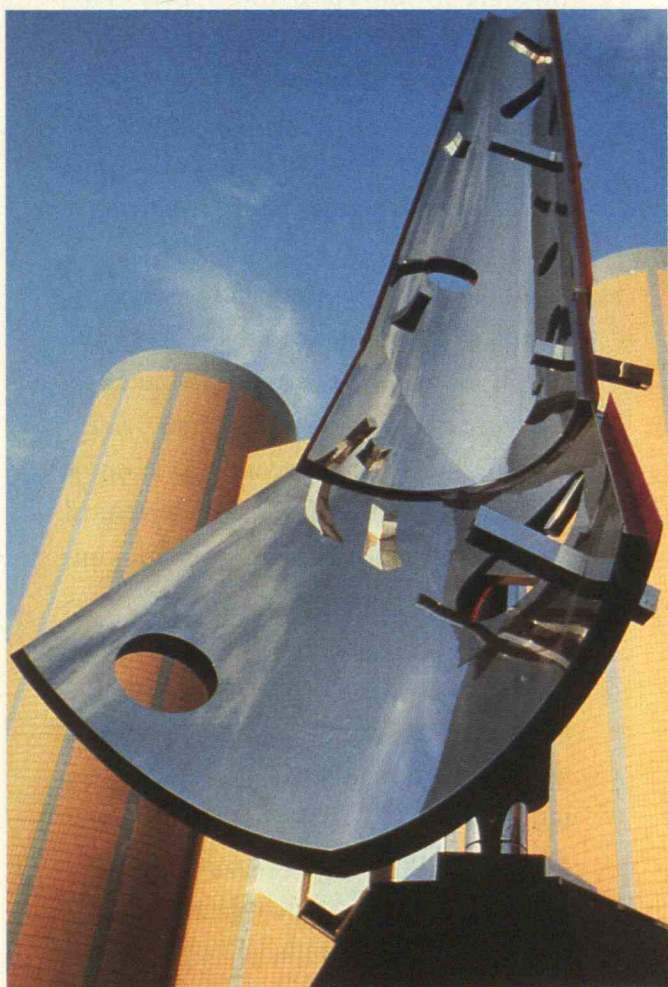
The sculpture also senses movement between its legs. When someone walks through the arch, an infrared sensor catches the motion and activates a microcontroller that randomly plays a recorded musical ditty. Trying to set off the music has turned into a game kids play on their way to the elementary school across the street.

This ever-changing sculpture, called "Garden of Light," is the work of Kiyoyuki Kikutake. Since the late 1970s, before the word "interactive" gained currency, he has been using his intimate knowledge of sensors, gears, bearings, and electronic controls to create works that respond to their environment. Kikutake has long worried that in modern life, people are increasingly cut off from their natural surroundings. Rather than attack progress, he has decided to

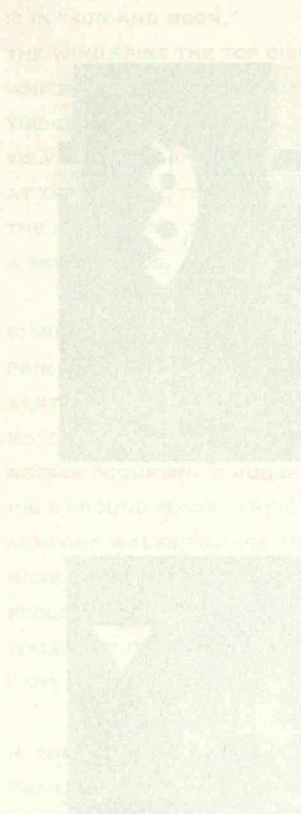
DENNIS NORMILE, like his subject Kiyoyuki Kikutake, formerly worked as an engineer. Normile is now Tokyo bureau chief for the news section of Science.



C



D



E



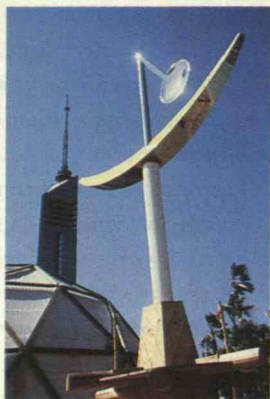
A: THE MOVEMENTS OF CHILDREN WHO ROMP BENEATH "GARDEN OF LIGHT" SET OFF AN INFRARED SENSOR THAT IN TURN CAUSES A MUSICAL CHIME TO SOUND. THE SCULPTURE ALSO RESPONDS TO ITS ENVIRONMENT THROUGH A SENSOR THAT NOTES WIND SPEED. THIS INFORMATION IS SENT TO A PUMP THAT PUSHES WATER UP THE ARCH'S LEGS: THE HARDER THE WIND BLOWS, THE HIGHER THE WATER MOVES BEFORE TRICKLING OUT FROM SPOUTS.

B: TEMPERATURE-SENSITIVE PAINT ON ONE SIDE OF "THE WORLD" CHANGES FROM YELLOW TO RED AND BACK AGAIN OVER THE COURSE OF A SUMMER DAY.

C: ONE WIND-DRIVEN SPIN OF THE WING ON "LA PAIX" TURNS GEARS THAT ROTATE THE SCULPTURE'S DISK 30 DEGREES.

D: SITTING NEAR THE ENTRANCE TO A BEER HALL, "BACCHUS" USES INFRARED SENSORS TO DETECT PATRONS, WHOSE APPROACH SETS IT TO TURNING AS IF WELCOMING THEM AND POINTING THE WAY IN.

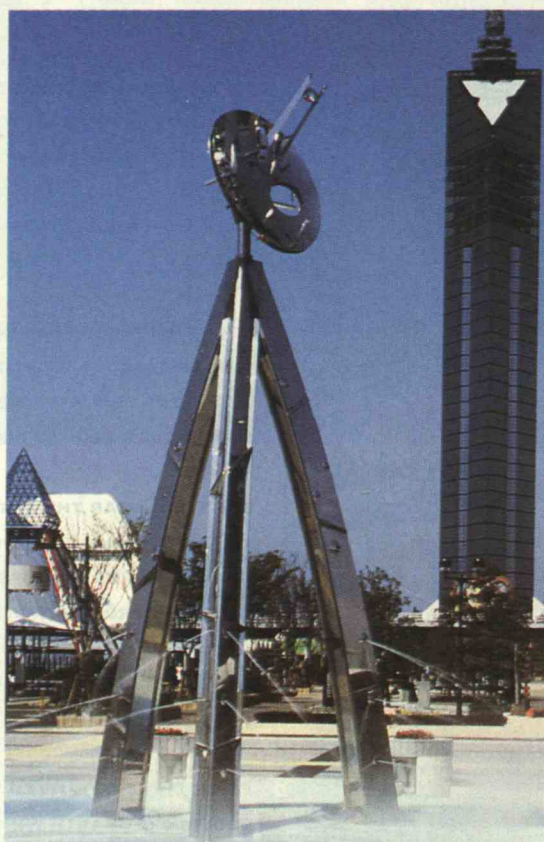
E: KIKUTAKE OUTFITTED THE SCULPTURE "EARTH WING" WITH A CARBON-DIOXIDE SENSOR AND MOTOR TO MAKE A POINT ABOUT POLLUTION LEVELS. THE HIGHER THE LEVEL OF CARBON DIOXIDE IN THE SURROUNDING ATMOSPHERE, THE FASTER THE ARTWORK'S VERTICAL COLUMN SPINS.



F



G



H



I

employ the tools of technology to make humans more aware of the world around them. "What I am trying to do is forge connections," Kikutake says, "between nature, people, and technology."

Today Kikutake is firmly established as one of Japan's leading sculptors. Hideo Tomiyama, director of the National Museum of Modern Art in Kyoto, describes Kikutake as "brilliant" for his innovative fusion of sculptural forms and high-tech effects. "No one else has really taken this kind of approach before," Tomiyama says.

To really appreciate Kikutake requires a look at the range of sculptures he has turned out. Consider, for example, "The World," placed outside the Tokyo Museum of Modern Art. A stainless-steel disk coated with a temperature-sensitive paint, this sculpture's color changes—most noticeably in summer—from yellow to red and back again in response to the daily rise and fall in temperature from dawn to noon to dusk.

The notion that sculptures may, like people, turn red with the heat may be simply amusing. But some of Kikutake's sculptures reflect more serious aims. "Earth Wing" is fitted with a carbon-dioxide sensor and a motor that turns a wing-like vertical column. Up to a certain atmospheric concentration of carbon dioxide the wing turns as if pleasantly dangling in a breeze. The piece is designed so that as the concentration rises, the turning gains speed, spinning in such a way that the wing appears increasingly unstable. Kikutake hoped this sculpture would be installed at a major urban intersection to reflect the ebb and flow of pollution associated with daily traffic. But a government institute dedicated to environmental research bought the piece and installed it in its lobby, where visitors see the



effect only by blowing on the sensor.

Many of Kikutake's works are intended to react to people. "The Four Seasons," which stands in a hotel lobby, consists of two shapes, a stainless-steel disk and arc—think "sun" and "crescent moon"—on separate pillars. Cued by infrared sensors, both shapes welcome guests by rotating when people pass by. Other works are intended to establish a connection between people inside a building and those on the street. In the days of small, low-rise buildings, Kikutake explains, passers-by had an intuitive feel for what might be going on inside. But now that many buildings turn a blank wall to the street, pedestrians lose any link with their surroundings. Hence "Star Gate," which sits outside an enormous multipurpose community arts center in Fukuoka, features two disks whose spinning speed correlates with the level of human activity within the building, again as measured by infrared sensors.

The fact that Kikutake's sculptures often respond to people's movements creates "a more intimate relationship" between viewer and artwork, says Naoki Takeda, author of numerous books on public art in Japan. "There is a universal fascination with technology," Takeda says, "and Kikutake's most significant achievement may be that his public monuments use technology to attract the attention of ordinary people."

Kikutake's path to creating such works was anything but typical. After graduating from Chuo University in Tokyo in 1968 with a degree in mechanical engineering, he worked in the design department of a small office-furnishings maker and later oversaw the numerically controlled machinery at a lumber processor. But the engineer became consumed by the possibil-

F: IN "SUN AND MOON," THE WIND SPINS THE TOP DISK, WHICH REPRESENTS THE SUN. THE CRESCENT "MOON" REVOLVES BY PUSHING HANDLES AT THE BOTTOM. THE FASTER THE MOON SPINS, THE QUICKER A BELL SOUNDS.

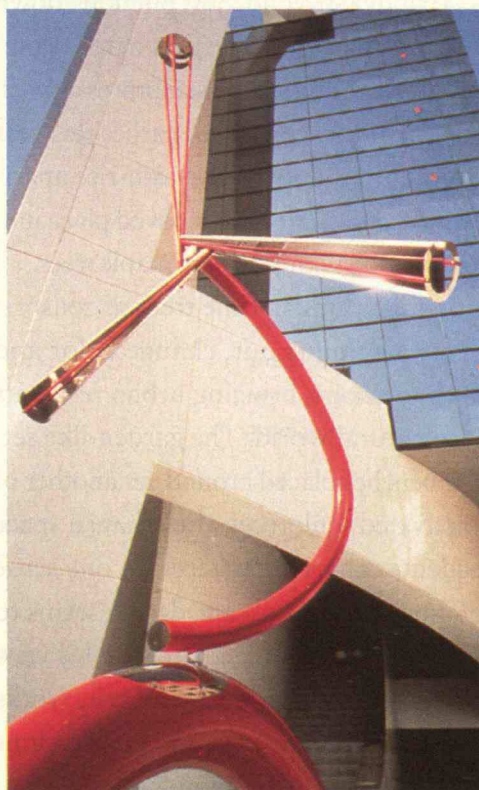
G: INFRARED SENSORS AT A PAIR OF DOORS NEAR "INTELLIGENT SCULPTURE" DETECT MOVEMENT TOWARD TWO BUSINESSES OCCUPYING A BUILDING'S GROUND FLOOR. WHEN SOMEONE WALKS TOWARD THE BANK, THE WING ATOP THE PEDESTAL MOVES. A PERSON WALKING TO THE PHONE COMPANY TRIGGERS A DITTY.

H: THE DISK AT THE TOP OF "WATERLAND" INDICATES WIND DIRECTION. PEDESTRIANS PASSING INFRARED SENSORS PLACED AROUND THE PLAZA TRIGGER CHANGES IN THE PATTERN OF SPOUTING WATER. AN ELECTRIC CHIME SOUNDS IF SOMEONE WALKS

THROUGH THE ARCH. PLACED IN THE CITY OF FUKUOKA, THE SCULPTURE CAN EXCHANGE SENSORY INFORMATION THROUGH A MODEM WITH SCULPTURES PROPOSED FOR OAKLAND, CALIF., AUCKLAND, NEW ZEALAND, AND BORDEAUX, FRANCE.

I: "STAR GATE," AT THE ENTRANCE TO A MAMMOTH CIVIC CENTER, IS INTENDED TO FORGE A CONNECTION BETWEEN PEOPLE INSIDE AND OUTSIDE THE BUILDING. INFRARED SENSORS IN THE LOBBY YIELD AN ESTIMATE OF THE NUMBER OF INDIVIDUALS THERE—WHICH DETERMINES THE SPIN RATE OF THE DISK AT THE RING'S CENTER.

J: THE CURLICUE SUPPORTING THREE TUBE-LIKE VANES ON "YUSHIN" ROTATES AT A SPEED PROPORTIONAL TO THE NEARBY BUILDING'S FOOT TRAFFIC. THE THREE VANES ALSO SWAY IN THE BREEZE.



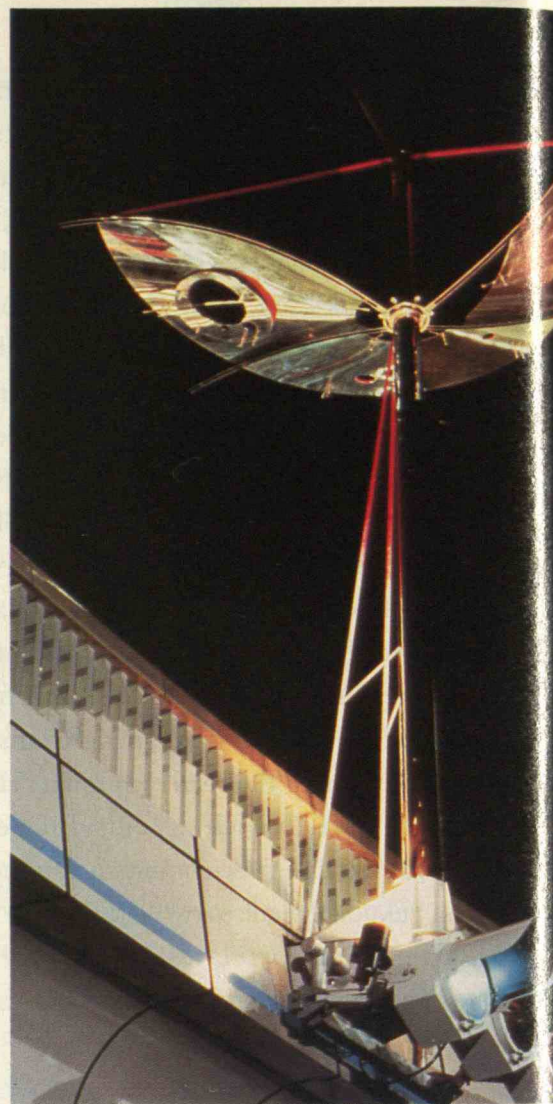


ity of using high technology to enhance people's awareness of nature and one another. "He has talked about nothing else for the last 20 years," says his wife, Michiko. He started spending evenings and weekends creating objects that seemed to defy categorization. "I worried about whether it could be called sculpture," he says.

The organizers of the first arts competition Kikutake entered didn't know what to call it either. They initially rejected his submission—a wall-hanging of stainless pipes that blew puffs of air at anyone passing by. But when the work was finally allowed into the contest, it won. Kikutake entered a second competition and won again. After a string of such awards, he received a Japanese government arts grant to spend a year studying art and doing research in the United States. When he returned to Japan in 1986, he gave up engineering and became a full-time sculptor—and the family survived on Michiko's earnings as a piano teacher.

Commissions gradually started coming in, and haven't stopped. Most recently, Kikutake's interest is expanding beyond "just plunking down sculpture here and there," as he puts it, to encompass the plazas surrounding the sculptures as well. For a project in Tokyo completed earlier this year he convinced the developers of a high-rise apartment to turn an area planned as a paved plaza into a thicket of bamboo with Japanese maple trees.

Kikutake thinks of the trees as sensors: maple leaves, he points out, change color and drop with the seasons, bringing urban residents closer to the natural world. The garden-like setting and the benches placed around yet another of his wind-activated sculptures also create a space where residents can casually meet. In one sense Kikutake's interest in landscape design seems to differ from his focus on gadgetry. But in his view he is simply extending the range of tools he works with to foster communication and connections among humans, nature, and technology. ■



K



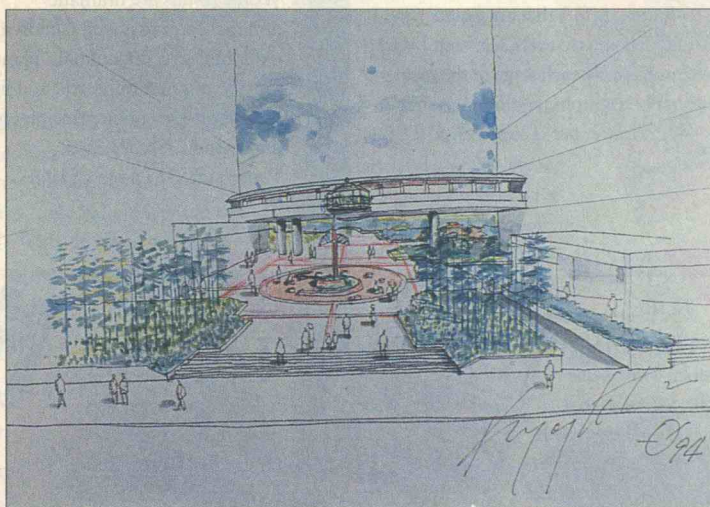
K



O



L



M



P

K: A WIND-DRIVEN SCULPTURE SITS NEXT TO TRAFFIC LIGHTS BY A PEDESTRIAN BRIDGE THAT KIKUTAKE DESIGNED. HERE HE DID NOT ADD SENSORS THAT WOULD TRIGGER EXCESSIVE MOTIONS DISTRACTING TO DRIVERS.

L: THE BRIDGE ADJOINING THE SCULPTURE INCLUDES GENTLE CURVES TO SOFTEN THE RIGID RECTANGULAR GRID OF A NEW URBAN AREA.

M: KIKUTAKE URGED THE DEVELOPER OF A HIGH-RISE APARTMENT BUILDING TO LET HIM DESIGN THE PLAZA AROUND HIS SCULPTURE "SINGING BIRD." KIKUTAKE'S SKETCH INCLUDES PLANTINGS OF BAMBOO AND MAPLE WHOSE SEASONAL CHANGES HE HOPES WILL REFRESH CITY DWELLERS.

N,O,P: WHILE THE UPPER PART OF "THE TACT" SIMPLY MOVES IN RESPONSE TO THE WIND, A MOTOR THAT TURNS ON AT ABOUT 5°C—THE TEMPERATURE AT WHICH PLANTS GERMINATE—DRIVES THE LOWER PART, WHICH ROTATES ACCORDING TO THE STRENGTH OF SUNLIGHT. THE BRIGHTER THE SUNLIGHT, THE FASTER THE ROTATION. A MICROPHONE THAT DETECTS SOFT SOUNDS OVER A LONG PERIOD OR LOUD NOISE OVER A BRIEF PERIOD WILL TRIGGER A CHANGE IN DIRECTION.

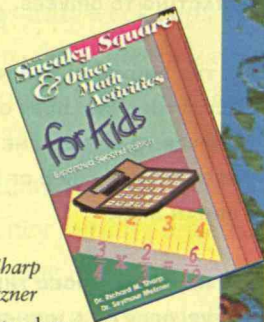
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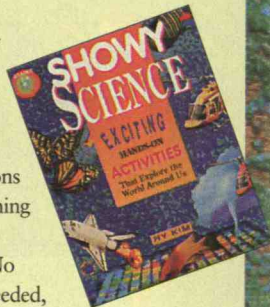
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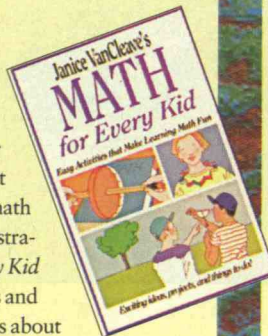
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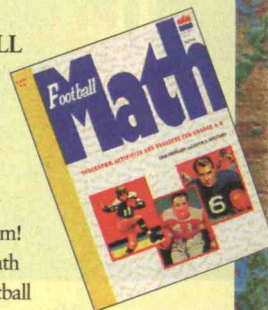
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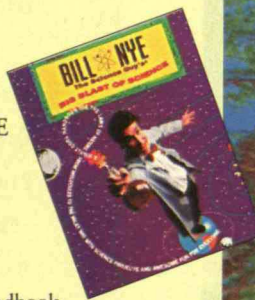
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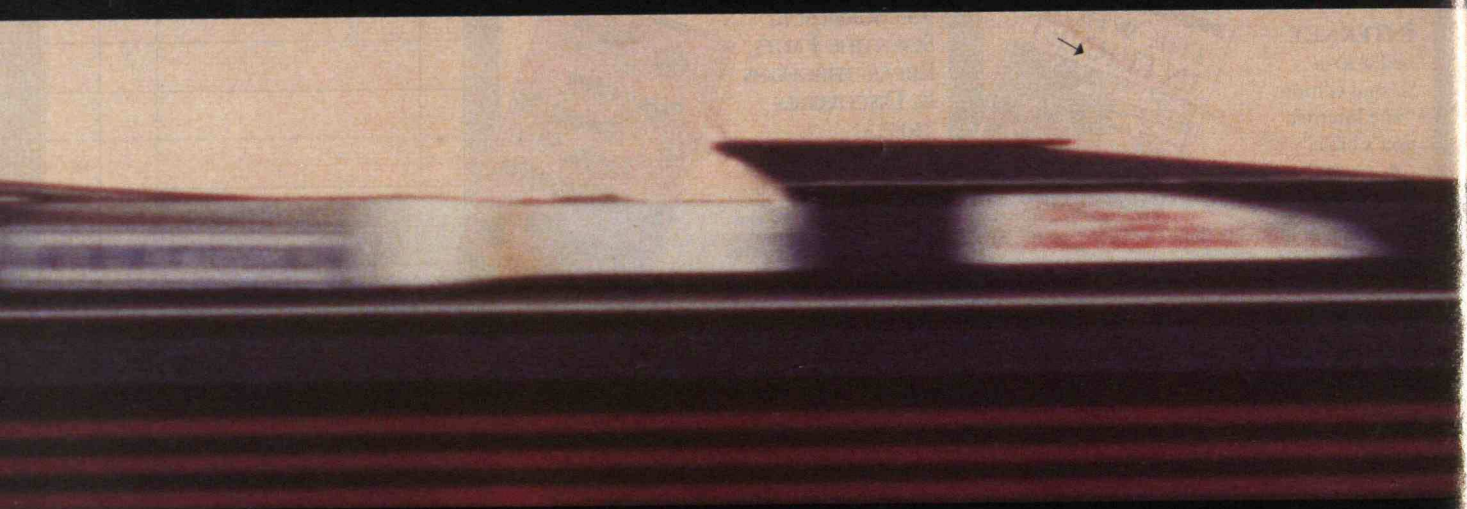
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Breaking the Sound

BY MARK FISCHETTI



IN A TEST AT SUPERSONIC SPEED, THE NOBLE TEAM'S SCALE-MODEL CRAFT CREATED THREE SHOCK WAVES (SEE ARROWS)—ONE EMANATING FROM THE FRONT TIP, ONE FROM THE BACK OF THE JET ENGINE, AND ONE (FAINTLY VISIBLE) FROM THE COCKPIT CANOPY (HIDDEN BY THE ENGINE HOUSING) HALFWAY IN BETWEEN.

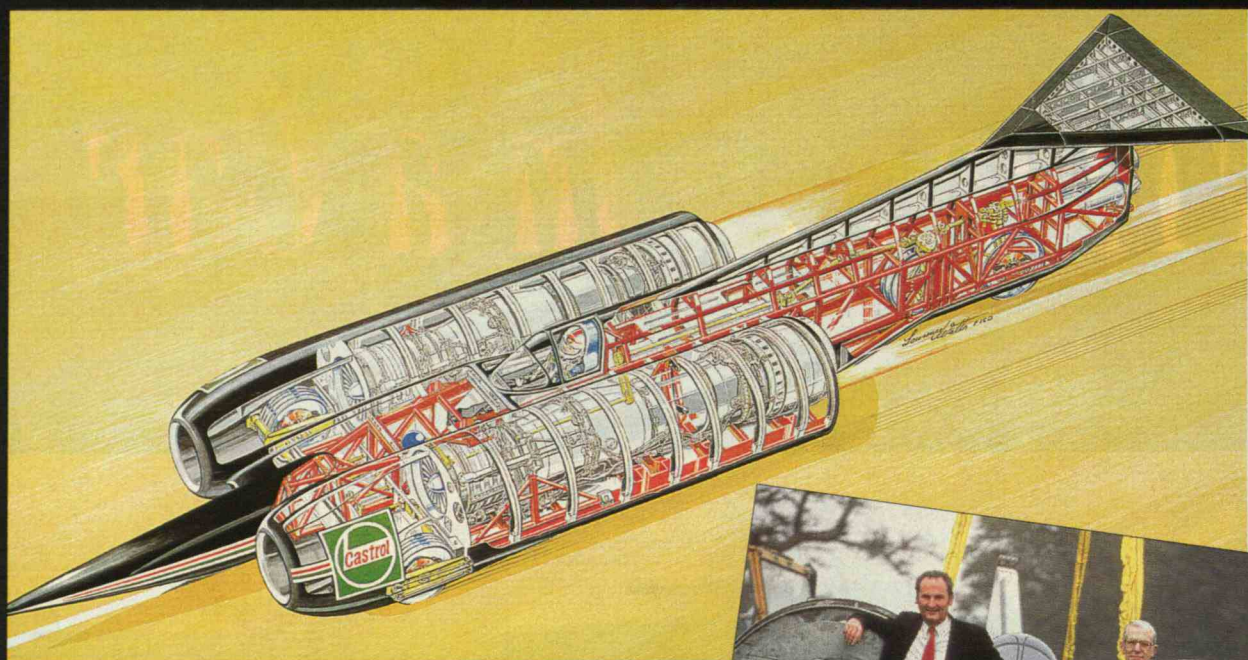
Barrier . . . *in a Car*



World record holders Richard Noble and Craig Breedlove both dream of boldly going where no race-car driver has gone before.

But their approaches are dramatically different.

Noble, a distinguished British technologist, is using the latest high-tech design tools to sculpt his supersonic craft. Breedlove, the consummate American mechanic, is building a machine he can modify by trial and error.



THRUST SSC, THE BRAINCHILD OF RICHARD NOBLE (INSET LEFT) AND CHIEF AERODYNAMICIST RON AYERS (RIGHT), FEATURES TWO JET ENGINES, TWO FRONT WHEELS, TWO STAGGERED REAR WHEELS FOR STEERING, AND A COCKPIT IN THE MIDDLE.

NO ONE WILL REMEMBER the name of the second person to break the sound barrier on land. That's why London's Richard Noble and California's Craig Breedlove are competing so earnestly to become the first. Noble and Breedlove have built prototype "cars" powered by jet engines that they intend to race across Black Rock Desert in northwestern Nevada this September at speeds exceeding 760 mph—Mach 1. As spectators of the big event, we'll find out whose vehicle can remain stable as a roiling jet of supersonic air rushes through the 10-inch corridor between each car's underbody and the ground, and which vehicle can withstand the supersonic shock waves.

We may also discover which of two opposing engineering philosophies will prevail. Noble, 50, who set the still-standing land-speed record of 633 mph in 1983, is managing a team of engineers who have used both supercomputers and facilities for testing military rockets to model the perfect configuration before building their car.

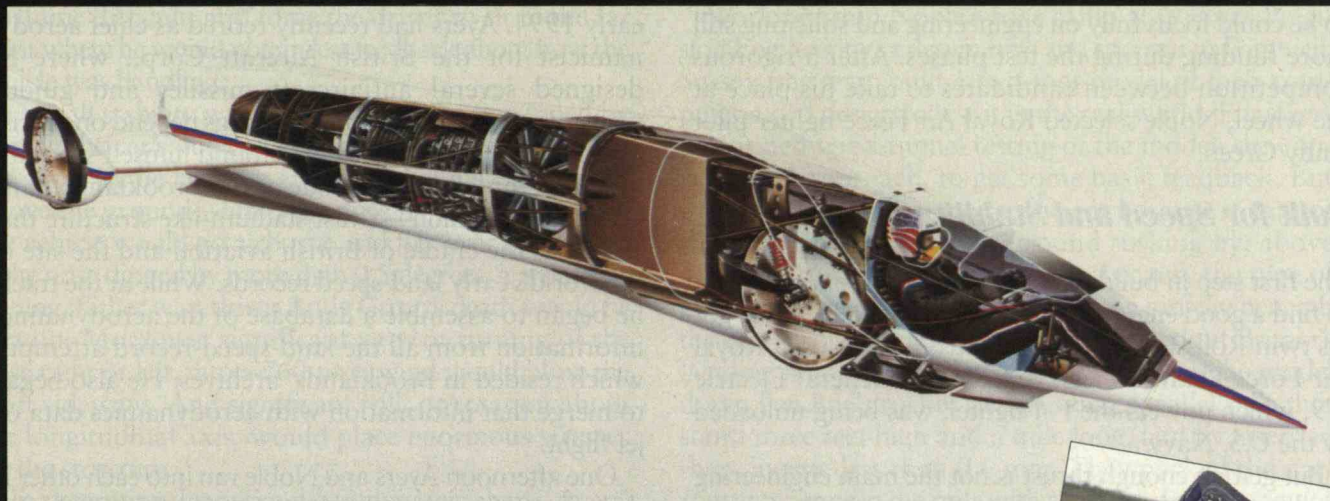
Breedlove, 58, a race-car driver since his teens and the first to break the 400, 500, and 600-mph marks, is heading a team of crack mechanics who have built a car they can readily modify by trial and error. Noble cooks by recipe, Breedlove by taste.

"We're not out to run a research project," Breedlove says. "Our mission is to get a record. If you get too complex you burden your objectives." He says his philosophy is "Keep it simple, stupid." Noble, a classic British sportsman, simply wishes Breedlove good luck.

Contradictory Designs

As a result of these opposing engineering styles, virtually every aspect of the adventurous duo's vehicles—the engine configuration, the aerodynamic shape, the steering and braking systems—are markedly dissimilar and often contradictory. Noble's Thrust SSC (Supersonic Car) is 54 feet long and weighs 7 tons. It has two jet engines that straddle the car's midsection, delivering a

MARK FISCHETTI, a freelance technology and business writer based in Great Barrington, Mass., has written for Smithsonian, Scientific American, and many other magazines.



combined 100,000 horsepower and 50,000 pounds of thrust. The driver is sandwiched between them, at the center of gravity. Breedlove's Spirit of America is 47 feet long and weighs 4 tons. It has one jet engine in the back delivering 45,000 horsepower and 24,000 pounds of thrust. The center of gravity is near the rear, while the driver is perched out front.

The Thrust has two front wheels and a staggered pair of wheels in the far rear, one slightly ahead of the other, which will steer the car. Spirit of America has a big, single front wheel, two conventionally placed rear wheels, and a rear steering rudder that Breedlove will use to tip the fuselage left and right, like an airplane. Thrust's wheels have no tires. Spirit's wheels have tires made from a wound carbon composite. For braking,

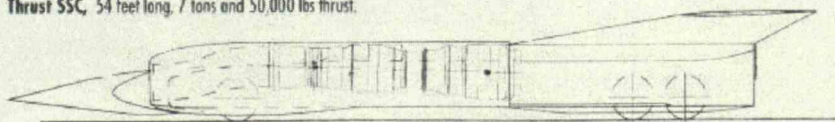
Thrust uses parachutes as well as disc-style brakes on all four wheels. Spirit augments its parachutes with a single braking ski that drops from the cockpit. Thrust burns jet fuel, while Spirit runs on good old 92-octane gasoline.

As project managers, Noble and Breedlove differ too. Breedlove has one huge financial sponsor, Shell Oil, and dozens of smaller sponsors. He wants his name in the record books, so he will drive the car. Noble is coordinating 174 sponsor companies, most of which are donating parts and services instead of cash. He is also raising funds with a grass-roots campaign on an extensive World Wide Web site; thousands of supporters have joined the online Mach 1 Club for about \$15 each. Realiz-

CRAIG BREEDLOVE CLIMBS ABOARD SPIRIT OF AMERICA, WHOSE DESIGN COULD HARDLY BE MORE UNLIKE THAT OF THRUST SSC. SPIRIT SPORTS ONE REAR ENGINE, ONE FRONT WHEEL, TWO PARELLEL REAR WHEELS, A STEERING RUDDER IN THE REAR, AND A COCKPIT IN THE NOSE.

HOW THEY COMPARE

Thrust SSC, 54 feet long, 7 tons and 50,000 lbs thrust.



Spirit of America, 47 feet long, 4 tons and 24,000 lbs thrust.



ing the project would be an enormous task, Noble made a painful decision early on not to drive the car, so he could focus fully on engineering and soliciting still more funding during the test phases. After a rigorous competition between candidates to take his place at the wheel, Noble selected Royal Air Force fighter pilot Andy Green.

Built for Speed and Stability

The first step in building an affordable supersonic car is to find a good engine at the right garage sale. Noble got his twin Rolls Royce Spey 205s from some used Royal Air Force Phantom jets. Breedlove's General Electric J79, which powers the F-4 fighter, was being unloaded by the U.S. Navy.

But getting enough thrust is not the main engineering challenge. As Noble's chief aerodynamicist Ron Ayers says, "Any idiot can go fast with a big enough engine. Doing it safely is another thing entirely." Indeed, the overriding task is to build a structure that can channel away the sonic shock wave and remain aerodynamically stable over the course of the race.

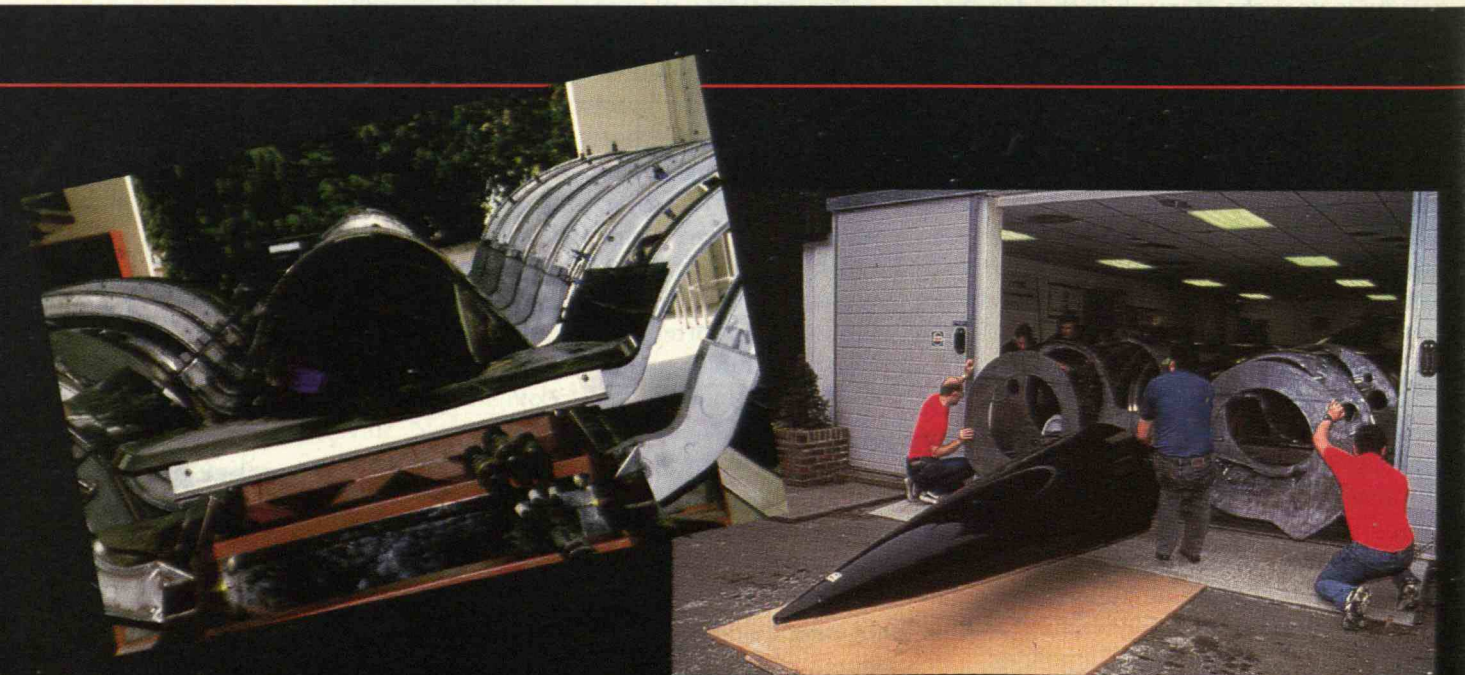
According to international speed-racing rules, a record speed is the average velocity a vehicle can sustain over a measured mile. Two passes, in opposite directions, are required, and the averages are averaged. To account for speed fluctuations that may occur during their runs, Noble and Breedlove are designing their vehicles to peak at about 800 mph to be sure of achieving a record of 760 mph.

As in aircraft design, the key to maintaining stability

is to control pitch, yaw, and roll. Noble was struggling with this problem when he bumped into Ron Ayers in early 1994. Ayers had recently retired as chief aerodynamicist for the British Aircraft Corp., where he designed several antiaircraft missiles and guided weapons whose deadly maneuverings depend on precise aerodynamic performance. He found himself spending time as a museum tour guide at the Brooklands Bank Track near London—a vast stadium-like structure that served as the cradle of British aviation and the site of the world's early land-speed records. While at the track, he began to assemble a database of the aerodynamics information from all the land-speed-record attempts, which resided in Brooklands' archives. He also began to merge that information with aerodynamics data on jet flight.

One afternoon Ayers and Noble ran into each other in the office waiting room of a mutual colleague. Noble told Ayers that he wanted to break the speed of sound with a jet-powered car because others were trying to depose his record, but that he knew nothing about jet aerodynamics. Ayers said he happened to have just about all the specs in the world on that, and was learning about fast cars. A partnership was soon formed.

Noble and Ayers decided the best way to control pitch, the back-to-front angle of the vehicle, was to move the center of gravity toward the center, like putting the heavy guy in the middle of a canoe. This novel design—unlike that of most high-speed race cars, which places the center of gravity in the rear—would require two engines slung on the sides of the fuselage. They felt a single engine



placed midway on the vehicle, conversely, would provide less lateral stability, make effective exhausting of the jet flume difficult, and force the driver to sit in the far front where he would obtain less feedback about how the vehicle was handling.

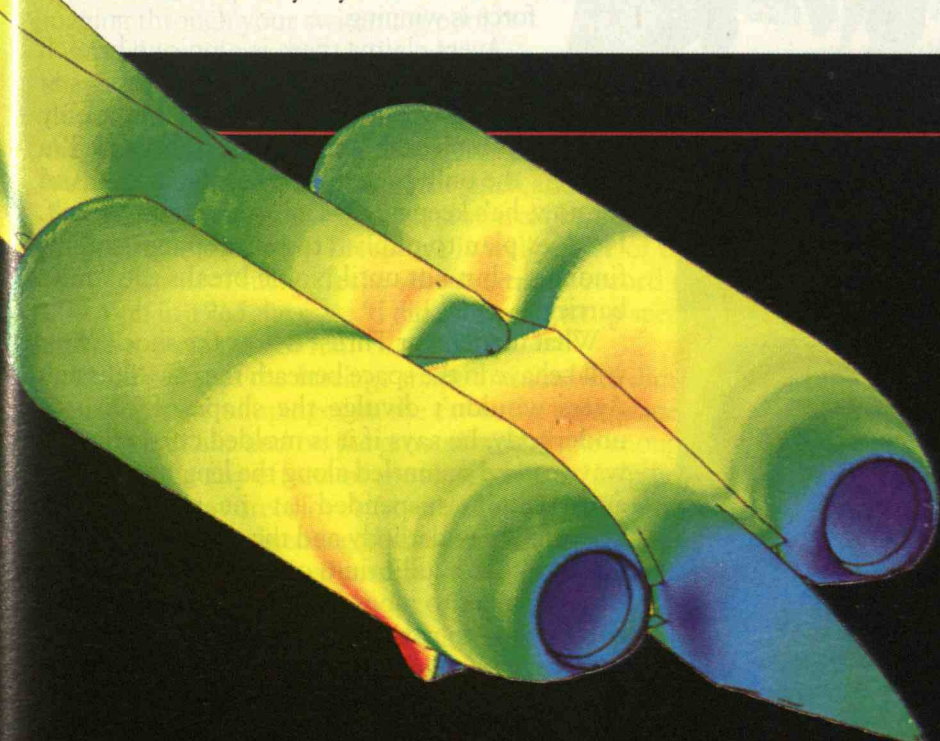
Overall stability would also have to be fine-tuned by honing the car's outer shape. If airflow over the car—a 7-ton projectile hurtling at 760 mph a mere 10 inches above the ground—lifted the nose by just 0.5 degrees, the vehicle would go airborne and flip over backward. If the nose dipped by more than 0.5 degrees, it would go mining. Either way, driver Andy Green's death would be certain. Moreover, significant yaw, or turning of the nose right or left, into a 760-mph wind would blow the craft sideways. And significant roll, or rotation about the longitudinal axis, would place enormous stresses on the structure.

To determine the optimal aerodynamic shape, Ayers, with the help of British engineering firm CDR Ltd. and Swansea University, used a Cray 92 supercomputer to perform computational fluid dynamics analyses, which showed the wind resistance Thrust would experience at supersonic speed. The computer produced color-coded images of the car showing the air pressure on every point on the vehicle as it accelerated from Mach 0.85 to Mach 1.15. Each image, which took the Cray on average 6.5 hours to complete, divided the car's exterior surface into 1 million spatial elements and showed the forces on each one. After each iteration, Ayers sculpted the vehicle's contours until he had achieved minimum wind resistance and maximum yaw, pitch, and roll stability. Ayers then made a 2.5-minute

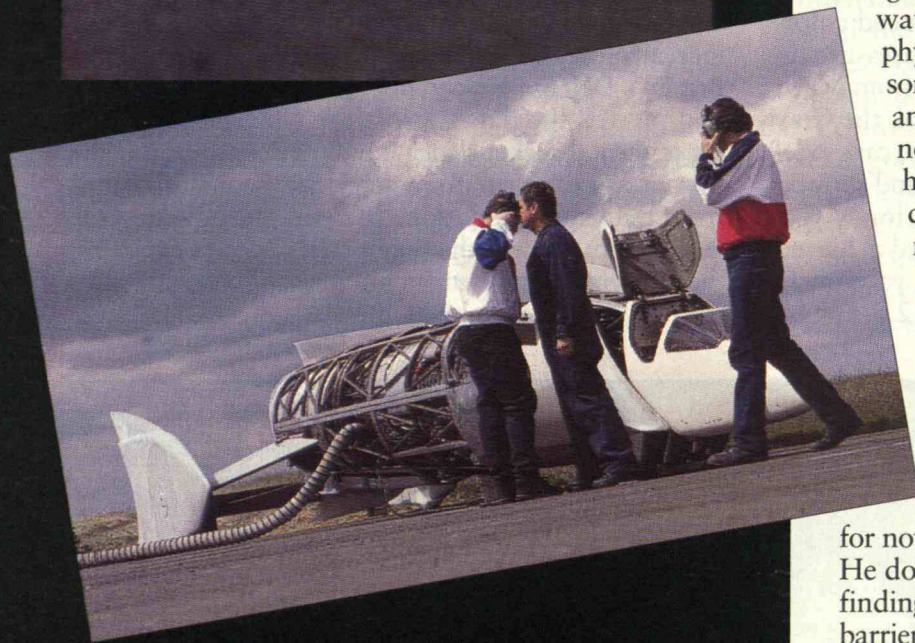
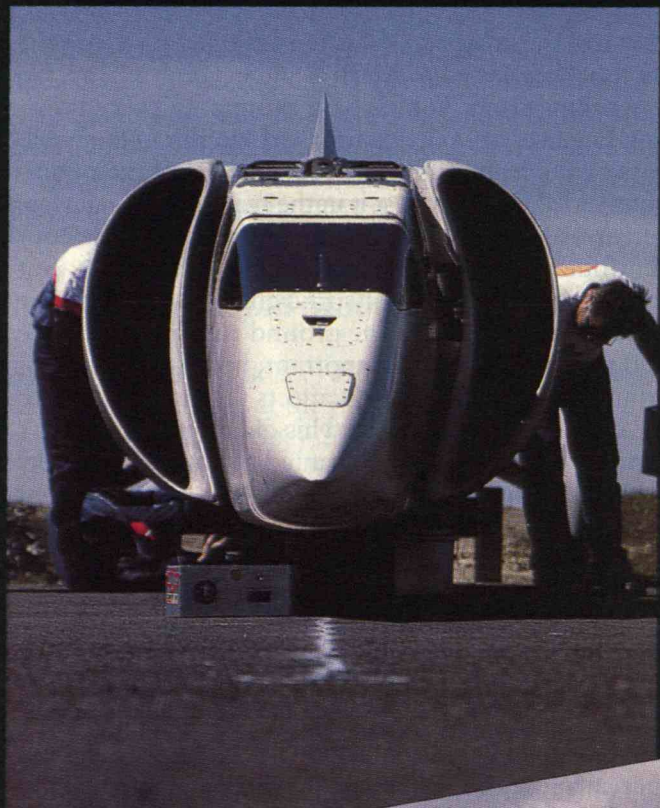
movie of the images to show the changing forces on the car as it accelerated to Mach 1 and beyond.

Working from Noble's base camp at G Force Precision Engineering, a design firm and sponsor in Fontwell, Sussex, the team built a two-foot model of their computer-aided design to test it in the real world. Engineers performed wind-tunnel testing of the model, the conventional approach, to get some basic feedback. But the tunnel alone was not sufficient because it cannot simulate the effects of the ground rushing by; above 400 mph this becomes important, because the type of ground surface significantly affects the airflow beneath the car. So Ayers approached his old friends at Britain's Pendine military base. He wanted to launch the model down Pendine's rocket sledge—two parallel rails that stand three feet high and a mile long, laid by lasers so they diverge less than 0.6 mm. They packed the narrow gap between the rails with sand nearly to the top so the model could zip over a surface similar to what it would find in the desert.

After applying dozens of pressure sensors all over the model, Ayers fired it down the line with a pulse from 18 two-inch blasting rockets. After making 13 runs at increasing Mach speeds, he took the results over to Britain's Defense Research Agency (another sponsor) and plotted the data against the Cray profiles. The experimental rocket-sledge numbers describing the airflow pressures on the car matched the theoretical figures from the Cray simulation. "There was an incredible correlation between the two models," Ayers exclaims, the excitement still clear in his voice. "I wouldn't have trusted either answer by itself."



A SUPERCOMPUTER SIMULATION OF THRUST SSC MOVING AT MACH 0.96 SHOWS THAT HIGH AIR PRESSURE (BLUE) WILL PUSH THE NOSE DOWN AND LOW AIR PRESSURE (YELLOW, RED) WILL CAUSE THE TAIL AND MIDSECTION TO RISE. TO COMPENSATE, NOBLE'S TEAM ADJUSTED THRUST'S FRONT SUSPENSION AND REDESIGNED ITS UNDERBODY BEFORE BEGINNING CONSTRUCTION (OPPOSITE PAGE).



RATHER THAN RELYING ON SIMULATIONS TO DETERMINE SPIRIT OF AMERICA'S AERODYNAMIC SHAPE, BREEDLOVE DESIGNED THE CAR FOR EASY MODIFICATION. IF HE EXPERIENCES AIRFLOW PROBLEMS ONE DAY, HE SAYS HE CAN RECONFIGURE THE FUSELAGE, HOUSINGS, OR FINS AND BE BACK ON THE TRACK THE NEXT.

Channeling the Sonic Boom

The two tests told Noble's team the exact pitch at which to build the car, the best height for the underbody, even the camber, or arching, of the nose and jet engine housings, to maximize stability. The tests also gave Ayers the answer to the most critical question of all: how to design Thrust to "manage" the sonic boom.

When the Concorde supersonic aircraft breaks the sound barrier, it sends a sonic boom—a violent pressure wave—into the atmosphere, which dissipates over many miles. If the plane is too close to land when it reaches supersonic speed, the shock wave can break the windows of buildings in the vicinity. Likewise, when Thrust punches through the sound barrier, the shock wave could reverberate off the ground and back into the vehicle with devastating force—that is, unless the vehicle can be shaped to contain the shock wave under the car.

Ayers says no one has really studied the so-called "ground effect"—what happens to the shock-wave airflow along the ground. He says that physicists and engineers assume there is some sort of "transonic" airflow—a mix of subsonic and supersonic airflows. But he claims there is no such thing. Rather, his two simulations have shown that subsonic and supersonic air, differing by only a few mph around the 760 mph mark, vie for control of the interface between them, creating a shock wave that fluctuates in space depending on which force is winning.

Ayers claims there is a unique branch of aerodynamic science that presides at precisely Mach 1. "For now, I'm the only person who understands it, because I'm the only person who has the data." And for now, he's keeping that information to himself. He does plan to publish technical papers on his findings—but not until Noble breaks the sound barrier.

What matters for Thrust is how the shock wave will behave in the space beneath the car. Although Ayers wouldn't divulge the shape of Thrust's underbody, he says if it is molded correctly, the wave can be channeled along the length of the car and remain suspended at near-equilibrium between the underbody and the ground.

Given that equilibrium conditions can change from moment to moment, Andy Green's life will depend on the car's most critical component: a reactive suspension system. "We can't treat Thrust as a car," Ayers says. "We must treat it as a 'ground-hugging servomechanism,' a new kind of moving craft with its own unique engineering." To

make that craft, Noble's team has positioned strain gauges to measure pressures on the wheels and hydraulic mechanisms on the suspension. Thrust's two onboard computers will monitor the readings and instruct the hydraulics to continuously reposition the car's pitch, thus countering pressure variations and keeping the shock wave trapped safely between the car and the ground.

Less Is More

Craig Breedlove is combating the same problems. And though he may not engage in computational fluid dynamics, he knows how to keep a car on the road—physically and fiscally. In fact, the first thing he did when he brought home his J79 engine was to convert it to run on gasoline instead of jet fuel. Why? "So I could get Shell to sponsor it," he says flatly.

Breedlove voices respect for Noble's accomplishments, but the Thrust SSC design doesn't make sense to him. "Richard wanted to get the center of gravity forward for stability, but that creates a tremendous down-force," Breedlove says. "So he needs big engines to power through it, but they create a large surface area between the belly and the ground, which in my experience causes more drag. The two engines also have a large frontal area, increasing wind resistance. He's doubled the power but tripled the drag."

Reducing frontal area is Breedlove's mantra. That's why he chose a single rear engine, giving Spirit the profile of a rocket. "My main concern is getting through this thick atmosphere on the ground," he says. "It's like jogging through your swimming pool."

Breedlove admits he's designed Spirit's aerodynamic shape "primarily by eye," based on what he's learned from building dozens of high-speed cars. With most of the weight at the back and a single wheel at the front, his main challenge is to control the pitch and yaw. Ron Ayers contends the car will dip and swivel like a weathervane fixed to a pole. Breedlove is well aware of the need to control such effects: when setting a record of 600 mph in 1965, he says, "I did a wheelie at top speed and that wasn't much fun."

Breedlove says the fuselage shape and fins will direct the airflow so it impinges on the car in the right places, keeping it in line and on the ground, and stable enough to overcome any effects of the shock wave. Help will also come from Breedlove's front wheel—actually three concentric disks joined together—that will act as a large flywheel; its moment of inertia will help keep the car from drifting side to side.

Rather than spend time on simulations, Breedlove prefers to build a full-scale prototype and modify it to combat the stresses he experiences during incrementally faster test runs. "I've done wind-tunnel work before," he explains, "and what I've found is this: you

can spend more money on the tunnel than it costs to build the car."

While intrigued by Noble's rocket sledge, Breedlove maintains that "unless you use full-size, real-ground tests, you can design the entire car on data that may not be applicable. The truth is, you can build a car in a way that allows you to make numerous aerodynamic adjustments once you're out on the track. You run it and change things. If I find I'm getting a pitch problem, I can take the car back to the shop, reconfigure it in a day, and go back out there." If he finds trouble with airflow underneath the car due to a sonic boom, he'll make adjustments there too, he says.

Where the Metal Meets the Road

Other significant differences between the prototypes include the tires, or in Thrust's case, the lack thereof. Indeed, rather than fitting a tire or some sort of impact-dampening material on Thrust's wheels, the British team has opted to use single, bare disks of forged aluminum. At Mach 1, the radial forces at the edge of the wheels, which will spin at 8,500 rpm, will be 35,000 g—or 35,000 times the gravitational force we feel at the earth's surface. Noble says that such force is enough to rip apart most materials, and that there's no way any kind of tire could hang on to the wheel. Noble chose aluminum because it has one of the highest strength-to-weight ratios of any material, able to withstand up to about 55,000 g. He says he will depend on the slight compliance of the hardened desert floor to cushion the rolling wheels.

Breedlove, by trade an engine and materials specialist, disagrees that the wheel cannot hold a tire. His wheels are also aluminum, but their rims are wrapped with layers of a composite carbon-glass material that will act as a tire. He says the impact from a pebble on a bare wheel could set off a harmonic that could migrate to the hub and cause catastrophic failure. To design the tire's contour, Breedlove did go to a computer, using finite-element analysis to determine the best way to apply numerous layers of fibers in many different directions so they would dissipate the stress of such an impact.

Steering presents another great divergence. When Breedlove roars across the desert, he'll steer Spirit with a rudder, just as planes or boats are steered. That's it. He says steering a single flywheel would require too much machinery, which would add weight and complexity and complicate the aerodynamic shape.

Andy Green will steer Thrust with offset, tandem rear wheels. Thrust's two big engines each require a wheel for support, but turning them into a supersonic wind could throw the car. A single rear wheel would swing the car back and forth too wildly to control. So the team built the offset pair, which are intended to counteract each other.

Another challenge is retaining structural integrity. To reach 800 mph and stop again before they run out of suitable desert, Thrust and Spirit will accelerate from 0 to 600 mph in about 16 seconds, and to 800 mph in another 14 seconds or so. The chassis and shell will have to withstand tremendous vibration from the jets and the buffeting wind, acceleration forces in excess of 40 g, and perhaps an 800 mph ding from a stone.

Each chassis is reinforced with structural beams, but the shells pose greater problems. They not only have to survive the forces, they also have to be modular so the race teams can easily pull them apart after each test run to alter the car. Because Breedlove's engine exhausts in the rear, he can use an aluminum skin all around that is common for high-speed craft. Noble's jet engines, however, will blast the rear third of his car, which will thus require a heat-resistant titanium skin to handle the hot jet exhaust. The front end is carbon fiber for stiffness, and the center is aluminum. Making the pieces modular requires extremely strong yet operable steel fasteners.

And so the differences go. Each team admires the other's track record, yet they are openly confounded by the "other side's" technical approach. "Breedlove has 30 years of single-engine experience," Ayers says. "If anyone can make it work, he can. So I guess if I were him, I'd stick with it. If Craig goes through Mach 1, well done Craig. But I believe ours is the ultimate solution."

The Designer versus the Mechanic

Noble and Breedlove have emerged as the two leaders among a handful of speed demons who will be trying to set the next land-speed record at various times and locales, among them Americans Gary Swenson and Art Arfons, Australian Rosco McGlashan, and an internal team at British carmaker McClaren. Noble and Breedlove have an empathetic camaraderie that can be shared only by those who are trying to defy the same daunting forces of nature, and putting lives at risk in the process.

Yet their personal styles are quite different. "Richard is the inspiration, the imagination of the Thrust SSC," Green says. "He's focused on much more than the car. It's the whole team effort, the Mach 1 Club, the Web site." Noble is always upbeat, rooting on his team, his contributing companies, and Ayers's scientific design approach.

Each month he also writes a column on the Web site (<http://www.thrustssc.digital.co.uk>) updating progress and conveying his personal hopes and fears. In April, Noble wrote: "Don't get me wrong, we are really enjoying the ceaseless battle. But it is taking its toll. I was in Gerlach, Nevada, three days ago and the joke running round Bruno's bar was that we are now aging twice as fast as our American friends." Noble also wants to get more young people interested in engineering. "That's

part of why we have a Mach 1 Club," he says.

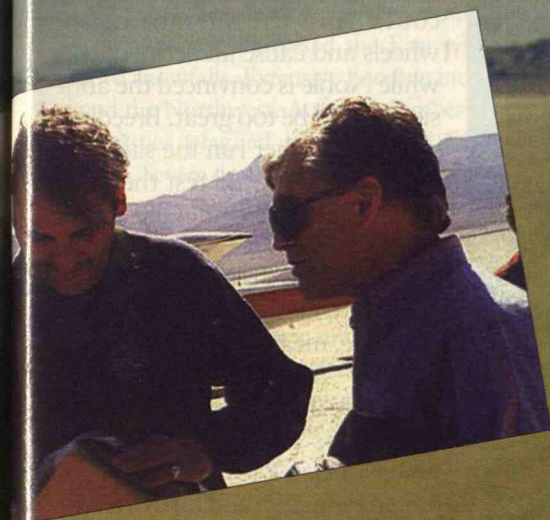
The Web site is exhaustive. It provides 250 electronic pages of in-depth background articles, numerous photos, audio clips, souvenir shopping, weekly progress updates, testimonies from crew members, and access to inside information for Mach 1 Club members. There's even a Help Wanted section; Noble has found several key team members with it, from a mechanical engineer to a cook. By mid-June the site was being accessed 55,000 times a week.

Breedlove, by contrast, is the consummate mechanic. He talks excitedly about fuselages and turbines and compressors and thrust. He bought his first car when he was 13. In 1953, at age 16, he drove the chopped up 1934 Ford hot-rod coupe 154 mph in speed trials on the Mojave Desert. He and his small circle of hands-on experts have been modifying cars for speed ever since.

Unlike Noble, Breedlove has no interest in public campaigns, Web sites, or groundbreaking aerodynamics research. He cares only about his car, his sponsors' support, and breaking the record. He has limited his team to a few people so he doesn't have to manage—he just has to get under the hood with them and modify things.

At this stage, whichever team approach works better will likely determine who breaks the sound barrier. By mid-June the desert race date was closing fast, and both camps had extensive work left to do, each squirreled away in its own mini-skunkworks. Noble has moved his group to an expansive hangar at the Farnborough air base 20 miles south of Heathrow, compliments of Britain's Defense Research Agency. DRA happens to be Andy Green's employer, and is looking to market its services to other nonmilitary clients.

The Spirit team is housed in a refurbished 12,000-square-foot building on Breedlove's sprawling homestead in Rio Vista, a small town along Highway 12 on the farmland between Sacramento and San Francisco. "It's beautiful out here," Breedlove says. "The townspeople are supportive, yet no one bothers us." His crew now basically lives there seven days a week. "We're like a big family. We're engaged in a work of love."



NOBLE AND BREEDLOVE
SIGNED AN AGREEMENT IN
APRIL (LEFT INSET) TO RACE AT
NEVADA'S BLACK ROCK DESERT
(SHOWN IN BACKGROUND)
THIS SEPTEMBER.

Gentlemen, Start Your Engines

The two teams were to shift into even higher gear in July. That's when they were to move camps to desert test sites in preparation for Black Rock, whose surface will be in prime condition from around mid-September, when it will have been baked hard and dry by the summer sun, for about four weeks until the October rains begin. If either Noble or Breedlove's schedules slip, they could miss the window.

Both crews will make test runs at higher and higher speeds all summer, checking, pushing, and optimizing every system, "from the parachutes to the porta-potties," Breedlove says. Both cars have been designed to be stripped down and reassembled in a few hours. Even Noble admits, "That's how real land-speed-record progress is made."

Breedlove is ahead of Noble thus far. He held his first

tie-down engine tests—where the jet engine is strapped to the floor and run for systems checks—in March. He found some minor intake-duct problems and some quirky instrument readings. Breedlove predicted Spirit will make its first low-speed runs—that means 250 mph—in mid- to late-July. From that point on, he'll make as many as six runs a day. "We'll probably be to record speed by mid-August," he says.

The Thrust was scheduled for tie-down tests in late June, and low-speed runs in July. Once the car surpasses about 600 mph the real tuning will begin. That's also when the driver takes on a pivotal role. "If Ron [Ayers] wants me to hit Mach 0.92 and hold it for 5 seconds so he can check a calculation," Andy Green says, "then I'll have to get Thrust there and hold it there, not at Mach 0.93 or 0.91, but Mach 0.92."

When Thrust and Spirit show up at Black Rock, both will have exceeded 600 mph. And though the quest is

for speed, breaking the record will depend on endurance. "When I take a fighter plane up two, three, four times a day," Green explains, "it's extremely tiring, mentally and physically. You have a tremendous adrenaline rush each time you gear up to fly on the edge of peak performance." Furthermore, he notes, the whole team "will be out there in the hot desert for 30 days, getting very little sleep, finding very little comfort. Yet we can't let ourselves slow down."

Breedlove, the racer, suddenly sounds like the corporate project manager when he explains how to cope with a month-long desert odyssey. "We have to look at it like a risk-management program. Yes, we'll be taking a risk every day. Yes, it will be scary. Yes, it will be grueling. We just have to manage it—mentally, technically, and operationally."

Carnival in the Desert

Black Rock Desert appears to be an ideal site for the supersonic challenge. The dry lake bed floods once a year and dries extraordinarily flat, hard, and consistent for the nine miles or so needed to reach top speed and decelerate again. The only paved surfaces long and straight enough are military runways, but even at the well-groomed Edwards Air Force Base in California, used for Space Shuttle landings, the runway has fissures, and dips and rises up to four inches. "Once you get over 400 mph," Breedlove says, "there's no time for the tires to drop to the ground between bumps. You can't steer the car if you're riding on a sheet of air."

Noble and Breedlove already have the permits for Black Rock. They would blast along a 13-mile strip of baked sand floor, alternating which team gets priority each day, increasing speeds as they are able. But by mid-June the gentlemanly spirit of "let the best man win" was crumbling under competitive pressure to become "the first." Neither camp seemed satisfied to wait for September to try to break the sound barrier. In fact, Breedlove was considering abandoning the Black Rock site entirely and conducting his time trials at the Bonneville Salt Flats in Utah, made of salt rather than sand, where other land-speed records have been set, including his own.



DRESSED FOR DISASTER: BECAUSE ANY CRASH AT MACH 1 WOULD LIKELY BE A FIERY AFFAIR, THRUST'S DRIVER ANDY GREEN WILL WEAR A SUIT, FACEMASK, GLOVES, AND UNDERWEAR MADE OF PANOTEX, A FABRIC THAT LOOKS LIKE COTTON BUT REPELS GASOLINE AND WITHSTANDS TEMPERATURES EXCEEDING 1,000 DEGREES C.

The salt surface is harder than sand, which reduces rolling drag. The downside is that the salt, which is much more abrasive, could ruin the surface of the wheels and cause an accident. But while Noble is convinced the abrasion would be too great, Breedlove says, "I'd rather run the salt." He indicated he would test the Spirit of America in Bonneville in late July, during a U.S. Flat Racers high-speed race there. "If I like it, I will stay there," he says.

Noble, meanwhile, had sent his brother Andrew to inspect a secret site in the Middle East. The secret was revealed on June 18 when Jordan's Prince Feisal, son of King Hussein and an avid high-speed racer, announced his country would provide a test site in the Jafr Desert near the remote Al Jafr Air Force Base. The Noble brothers say the Jafr Desert has hard-

ness and consistency equal to or better than that of Black Rock. They had already outlined a 10-mile track that would easily accommodate daily test runs up to 650 mph, beginning July 15. Prince Feisal pledged considerable government and military support for the test operation. Among the hazards that will have to be watched, Andrew Noble says, are locals with fairly loose control over both their trucks and livestock.

As of now, however, the race is still scheduled to take place at Black Rock, beginning about September 10. The roaring engines, sonic booms, turbulent dust trails, crush of global media, and anticipated 100,000 spectators will be spectacle enough. But the dynamic duo will not be the sole attraction on the desert floor. The Aero-Pac amateur rocket association already had plans to launch 100 large rockets a day from Black Rock in September. Some 5,000 people will also be participating in the Burning Man Festival, which involves the symbolic torching of a 40-foot wooden statue. If that's not circus enough, the National Historic Trails Association will be marking the 150th anniversary of the important Applegate-Larsen immigrant trail by leading a train of restored covered wagons along the route. The trail traverses the northern end of the desert, but if the wetter sands there are too boggy, the convoy will cross Black Rock further south—at right angles through the 800-mph course.

"Whatever else," the wry Ayers says, "it won't be dull." ■

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Stormy Weather, Clear Views

Hurricanes, blizzards, and floods, oh my!

Recent exemplary forecasting reminds us of the value of government

R&D linked to the public good.



ROBERT M. WHITE

THE past year inflicted record-breaking weather on many parts of the country. Severe winter storms blanketed the East with record snowfalls. Extensive flooding inundated the Northwest. A record number of hurricanes plagued the Gulf and East Coasts. Severe droughts and resulting fires caused extensive damage in the Southwest. These weather extremes resulted in enormous disruptions and costs.

The public, naturally, seeks to understand the causes of these unusual events—particularly if such knowledge can lead to improved forecasts and warnings. But the news media have resorted to speculative explanations, in many cases buttressed by the views of some scientists, attributing the extreme events to global warming from the emission of greenhouse gases or to the effects of El Niño, the periodic warming of the waters in the tropical Pacific Ocean. Epitomizing this alarmism was a *Newsweek* cover line: “Blizzards, Floods, and Hurricanes: Blame Global Warming.”

But such connections are unproven, and indeed do not need to be invoked to explain what has been happening. Atmospheric conditions are naturally variable from day to day, even when overall climate, which is the average of these daily events, remains stable. Inevitably, weather extremes and anomalies result. Global warming and El Niño are worthy of the investments now being made to study their seasonal, year-to-year, and climatic consequences. However, a public led to believe that these phenomena directly influence daily weather will inevitably become disillusioned with the value of this research when expectations are not realized.

The irony is that if one looks beyond such speculative explanations, recent years have showcased real progress in meteorological science and technology, revealing just how accurate forecasting has become. Sophisticated models of weather systems, enabled both by better understanding of atmospheric dynamics and by the availability of powerful computers, predicted with uncanny accuracy the courses of blizzards and hurricanes. Timely warnings gave businesses, communities, and individuals ample opportunity to prepare.

Technology has been key to this improvement. Satellites provide forecasters with easy-to-comprehend data on the distribution and movement of storms and cloud systems, as well as the data on atmospheric temperature and moisture that provides the grist for the computer models. Doppler radars, which measure from afar the velocity of airborne particles, have greatly improved tornado forecasting. Warnings of tornadoes, where minutes count, are now issued on average 15–17 minutes before a twister strikes, as contrasted with the typical 5–10 minute lead time that older technology typically provided. Only 13 percent of tornadoes now hit without warning, down from 33 percent 10 years ago. The new radars have also boosted by almost 60 percent the chance of detecting a flash flood early enough to provide useful warning. And meteorologists can now make 48-hour pre-

dictions of temperature and precipitation with the same confidence they brought to 12–24 hour forecasts two decades ago.

Programs planned or in the works will provide further aid to forecasters. One idea is to use the Global Positioning System satellites, designed as navigation aids for military purposes, as microwave probes to generate continuous readings of temperature and humidity throughout the atmosphere. A new communications and data-display system—the Advanced Weather Interaction and Processing System, or AWIPS—will provide a graphics-rich presentation of information compiled from satellites, radar, and surface observation stations. AWIPS, which is expected to be fully in place by 1999, will help meteorologists analyze fast-breaking storms and permit them to issue quicker forecasts and more precise warnings.

In addition to refining the tools of their trade, meteorologists also seek a deeper understanding of how weather works. The proposed U.S. Weather Research Program would mount a scientific assault to better our understanding of the behavior of small-scale destructive phenomena such as tornadoes, thunderstorms, and flash floods. By studying the detailed wind and physical structure of these phenomena, the program will seek to improve predictions of their motions and intensities.

Weather touches the lives of every citizen and every business in myriad ways. With the possible exception of medicine, no science and technology has greater effect on our daily lives. Weather-related research is an example of well-conceived basic and applied research and the harnessing of these advances for the public good. Over the past quarter-century, federal investments have more than paid for themselves in improved warnings and protection. This achievement deserves celebration and continuation, and should not be obscured by speculative attribution of bad weather to long-term climatic changes. ■

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As the presidential campaign enters full swing, we brace ourselves for the barrage of vapid sound bites, sleazy attack ads, and ritualized TV debates that pass for political communication these days. Voters worried about jobs and the standard of living listen attentively as candidates outline their plans for the economy. Clinton will no doubt suggest that modest government initiatives will help bring prosperity. Dole will answer that government is obnoxious, that the private sector can do just fine on its own. But unless a miracle happens, both men will simply echo threadbare homilies about economy and society—ideas that made sense 30 years ago but no longer speak to urgent problems that ordinary folks understand perfectly well.

We'll hear, for example, inflated rhetoric about ways to boost productivity and economic growth, suggesting that the benefits of growth will somehow be fairly distributed. After all, a rising tide lifts all boats, as John F. Kennedy liked to say. But in fact, growth has moved along at a steady clip in recent years. The problem is that most of the increase has gone to the upper 20 percent of the population; for the vast majority of workers, real wages are about where they were in the late 1950s. We're in the midst of what Wall Street banker Felix Rohatyn calls a "huge transfer of wealth from lower-skilled, middle-class American workers to the owners of capital assets and to a new technological aristocracy." At issue is rapidly expanding social inequality, a grave malady that threatens the very foundations of our democracy.

To face this problem squarely, our candidates would have to answer some embarrassing questions. Mr. Dole, in your view what fair share of our economy's productivity gains ought to go to ordinary workers as compared to shareholders and upper management? Mr. Clinton, since earlier mechanisms for distributing America's prosperity—collective bargaining, for example—have broken down, what new ones should be created in their place? Rather than answering these questions, however, the reality-challenged contenders will likely parrot vacuous slogans about

Immune to Serious Issues

Bill Clinton

and Bob Dole have a splendid opportunity to debate the country's technological and economic path.

Don't hold your breath.



LANGDON WINNER

the need to "grow the economy." Just add water and fertilizer and stir.

Another platitude spinning at the top of the presidential hit parade celebrates the supposed link between training and competitiveness. Politicians love to propose raising the skill levels of American workers so that they can "compete" with others in the global economy. This sounds like good advice; who could possibly object to creating a smarter, better prepared workforce? Unfortunately, most jobs created these days are low wage, low skill, and semi-automated, entailing work that requires little if any "training." More important, companies that are ostensibly American are now pitting the nation's workers against those in Asia and Latin America, driving wages down regardless of level of training.

Before they admonish us to hustle off to night school to restore our competitive edge, the candidates might speak directly

to problems in the way today's economy is organized, and how these problems might be fixed. Mr. Clinton, which kinds of workplaces, technological systems, and economic arrangements would provide a good life for the next generation? Please tell us, which jobs under what conditions would meet this goal? Mr. Dole, what will your administration do to check the alarming power of what Pat Buchanan called the "animals of Jurassic Park"—the transnational corporations?

Both contenders need to specify what kinds of research, development, and institutional change would build a global economy that is both prosperous and fair. And both need to explain how their policies would seek to guide the forces of globalism rather than slavishly conform to them.

Of course, the likelihood we'll hear any of these topics discussed is virtually nil. The influence peddlers who pay the bills and campaign managers who write the presidential scripts have entirely different concerns in mind. Embarrassing questions about economic inequities are shunted aside in favor of old-fashioned boosterism and the opinion maker's favorite myth: blaming social disorder on the decline of "family values."

The absurd posturing of the 1996 campaign points to a political system that has developed an immune response to the intrusion of serious issues. Discussion of urgent, widely shared problems is displaced by pompous blather about welfare mothers, illegal immigrants, Hollywood filmmakers, and other scapegoats. Most voters realize they are being jerked around, that their real concerns are never addressed. But in today's elections, citizens rarely talk to politicians and are repelled as their views are distorted by layers of pollsters, journalists, and professional image-makers. If ordinary folks had a chance to shape the upcoming debates directly, they might stand before the podium and exclaim: "Please, Mr. Candidate. Let's get real." ■

LANGDON WINNER is director of graduate studies in the Department of Science and Technology Studies at Rensselaer Polytechnic Institute. His e-mail address is winner@rpi.edu.

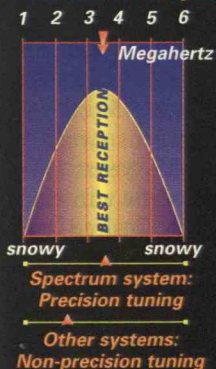
Fifteen years of microelectronic research makes conventional antennas a thing of the past!

This little box uses your home's electrical wiring to give non-subscribers, cable subscribers and satellite users better TV reception on local broadcast networks!

Technology corner

Why don't conventional antennas work as well as the Spectrum?

Bandwidth of TV Signal



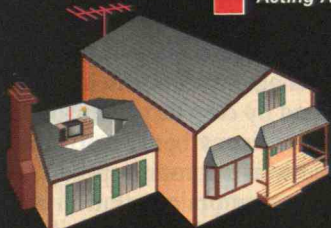
■ When TV signals are tuned at the TV channel's center frequency, optimum tuning has been achieved.

■ Other antennas can't offer center frequency tuning like the Spectrum Antenna can. They only offer such tuning up to the edge of the center frequency. As a result, your TV picture remains snowy.

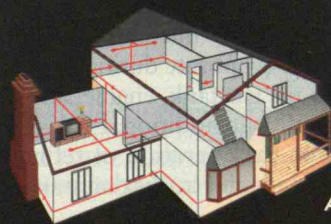
How does Spectrum use a home's electrical wiring as an antenna?

Believe it or not, the Spectrum Antenna simply "activates" the giant antenna that already exists in your home. Essentially, it uses all of the wiring throughout your home's walls and ceilings to make an antenna as large as your house for unbelievably clear reception of local broadcasting.

■ Acting Antenna



Before



After

Until recently, the only convenient way to guarantee great TV reception was to have cable installed or place an antenna on top of your TV. But who wants to pay a monthly cable fee just to get clear reception, or have rabbit-ear antennas that just don't work on all stations? Some people just aren't interested in subscribing to cable. Or they may live in an area where they can't get cable and TV-top antennas aren't powerful enough. And what about those people who have cable or satellite systems but still can't get certain local stations in clearly?

Now, thanks to fifteen years of microelectronics research, a new device has been developed that is so advanced, it actually makes conventional antennas a thing of the past. It's called the Spectrum Universal Antenna/Tuner.

Advanced technology. Just imagine watching TV and seeing a picture so clear that you'd almost swear you were there live. Just plug the Spectrum Antenna into a standard AC outlet and plug your TV into the Spectrum. You can remove the unsightly clutter of traditional TV-top devices gathering more dust than television signals. Get ready for great reception. Your TV will display a sharp, focused picture thanks to Spectrum's advanced "Signal Search" and "Fine Tuner" controls.

Uses your home's electrical wiring. The Spectrum Antenna is a highly sophisticated electronic device that connects into a standard wall outlet. The outlet interfaces the Spectrum Antenna with the huge antenna that is your home wiring network. It takes the electrical wiring in your house or apartment and turns it into a multi-tunable, giant TV reception station which will improve your TV's overall tuning capability. The results are incredible. Just think how much power runs through your home's AC wiring system—all that power will be used to receive your local broadcasting signals.

How it works. Broadcast TV signals are sent out from the local broadcast station (ABC, CBS, NBC, etc.). They interface with your home's AC power line system, a huge aerial antenna network of wiring as large as your home itself. When the Spectrum Antenna interfaces with the AC line, the signal is sent to its signal processing circuit. It then processes and separates the signal into 12 of the best antenna configurations. These specially-processed signals route themselves into 12 separate circuits. The Spectrum Antenna includes a 12-position rotary tapping switch, the "Signal Switch" control, which gathers 12 of the best antenna configurations.

Parallel 75 ohm resistance
For minimum loss of signal

Signal search control
For selecting multiple antenna configurations

Resonant fine tuner control
For dialing in crisp, clear TV/stereo reception, eliminates ghosting

Dual outlets with surge protection

For plugging in additional TV/stereo equipment, guarding against damage and surges

The "Signal Search" offers varying antenna configurations for the user to select from the best signals of all those being sent. The signal then passes through the Spectrum Antenna's special "Fine Tuner" circuit for producing crisp, clear reception.

Rural areas. If you live in a rural area you may need to enhance the incoming signal—most rural areas signals are weak, making them harder to fine tune. The "Gain Booster" is a high-frequency signal booster designed to increase the output level of the signal entering your television. It delivers a 10-fold greater signal which will bring richer color and a noise-free picture. By using the "Gain Booster," all of the Spectrum's fine tuning controls will function better, giving the Spectrum Antenna a stronger signal to fine tune. It also works in conjunction with your outdoor antenna.

Risk-free offer. The Spectrum Universal Antenna/Tuner comes with our exclusive 90-day risk-free home trial and a 90-day manufacturer's warranty. Try it, and if you're not satisfied, return it for a full "No Questions Asked" refund.

Limited time offer! We realize that most people have more than one TV in their home. We are offering a special discount on additional Spectrum Antennas so you can get great reception on all your TVs!

Spectrum Antenna \$39 \$4 S&H
Additional antennas just. . . . \$34 S&H free
Gain Booster \$19 \$2 S&H

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EVs: Clean Today, Cleaner Tomorrow

THE debate about electric vehicles (EVs) often revolves around whether increased smokestack emissions—from the power

plants generating the electricity needed to recharge all those EV batteries—will offset the reduction in pollution from tailpipes. Such analyses usually overlook a critical factor, however: gasoline cars tend to get dirtier and dirtier over time, while electric power plants do not.

According to the U.S. Environmental Protection Agency, pollution from tailpipes grows by an average of 25 percent every 10,000 miles, culminating in vehicles that are 2 to 5 and sometimes 10 times dirtier than when they left the assembly line. Indeed, because of this steadily deteriorating efficiency, a gasoline car will over the course of its working life emit twice as much nitrogen oxides (NO_x) as will a generating facility producing the power to charge a comparable electric vehicle. The conventional car will also spew out 60 times more carbon monoxide, 30 times more volatile organic compounds, and twice the carbon dioxide emissions as the electric power plant. This comparison assumes that electric vehicles will be recharged with power drawn mainly from oil- and natural gas-fired generators.

Maintaining the emissions control systems in millions of individually-owned vehicles has proved extremely difficult. Indeed, in the northeastern United States, the single largest source of air pollution is aging gasoline-powered vehicles. Recognizing this fact, several Northeast states announced plans in 1993 to upgrade their automobile inspection and maintenance systems. In some states, these programs are expected to eventually achieve up to 40 percent of the reductions in volatile organic compound emissions necessary to comply with new clean air



*Gasoline cars
get dirtier as they age.
But electric vehicles draw
power from centrally
operated facilities that
tend to pollute less
over time.*

standards. Unfortunately, most of these programs have been delayed, in large part due to concern about public response to the cost of repairing catalytic converters and other such components. Utilities, by contrast, employ teams of professional engineers to keep the power plants well maintained and operating at peak efficiency.

Another benefit unique to electric vehicles is the immediate reduction in air pollution over the entire EV fleet

once new power-plant-emission controls are installed. Under pressure from regulators, for example, electric utilities in the Northeast have committed to reducing power plant emissions of NO_x by 55 to 75 percent over the next seven years. The entire fleet of EVs will reap the environmental advantage of this upgrade at a few hundred facilities. With gasoline vehicles, by contrast, the benefits from more stringent new emissions standards are realized only incrementally as older vehicles are junked and replaced. Since 95 percent of the fleet turns over only after 12-15 years, more than a decade can elapse before the desired emissions reductions are achieved.

Because of the rising popularity of gas-guzzling sport utility vehicles, which now account for more than 40 percent of new vehicle sales, the overall efficiency of passenger cars has dropped in the last several years. EVs, on the other hand, are entering the market as highly fuel-efficient machines. The General Motors EV1, for example, gets the equivalent of 100 miles per gallon.

Moreover, gasoline vehicles of all kinds are often restarted several times a day, and, once running, the engine must frequently change speed as the vehicle accelerates, decelerates, and traverses hills. Such sporadic and variable operation works against fuel efficiency. EVs are charged by electric generators that reap the efficiency benefit of running continuously at a constant speed.

Not all automobile pollution comes from the tailpipe. About a third of the volatile organic compounds that gasoline automobiles introduce into the atmosphere evaporate during refueling and from the gas tank, engine, and fuel line. Significant additional emissions come from the operation of refineries and from ships and trucks that transport

the liquid fuel. Electric vehicles reduce these emissions as well as exposure at the gas station to the toxic chemicals present in gasoline, such as benzene and 1,3-butadiene.

Over the next fifteen years, EV batteries in the Northeast will increasingly be recharged by modern natural gas-fired power plants. These plants are much cleaner and more efficient than today's coal or oil-fired plants. For example, facilities in Southern California already emit 40 times less NO_x than Northeast power plants.

And unlike conventional vehicles, which run almost exclusively on petroleum-based fuels, electric vehicles are able to tap into a large number of power sources, including renewables such as hydro, wind, geothermal, and biomass. In a demonstration project run by the Massachusetts energy office, solar cells provide the electricity to recharge EVs parked at two commuter rail train stations in the Boston area. Solar panels on the roofs of houses could collect solar energy by day and use it to charge a spare EV battery. Once home, the motorist would simply exchange today's spent battery pack with the newly charged one.

The move to EVs must be understood as a long-range air-quality strategy. It will take many years from the time EVs are introduced until even half the cars on the road are electric. Ultimately, EVs can make a difference only if people buy them. In the near term, consumers will have to choose between internal-combustion vehicles that offer the romantic roar of a V8 and 500-mile road trips, and electric vehicles that zoom silently from 0 to 60 and can be recharged overnight in their garage. Over the long term the clean-air payback will become apparent as gracefully aging EVs supplant the elderly, atmospherically incontinent fleet of gasoline cars. ■

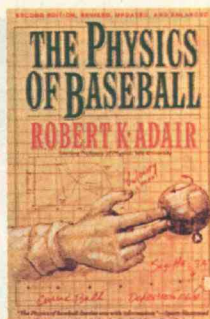
DREW KODJAK is attorney for mobile sources at Northeast States for Coordinated Air Use Management (NESCAUM) in Boston, an interstate association of air quality control agencies.

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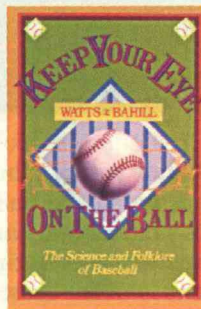
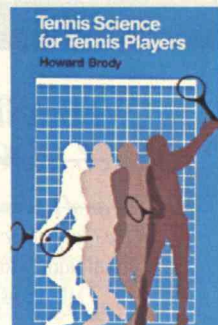
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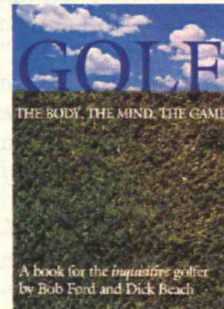
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Reviews

BOOKS

WEB AND WILD

*The War of Desire and Technology
at the Close of the Mechanical Age*

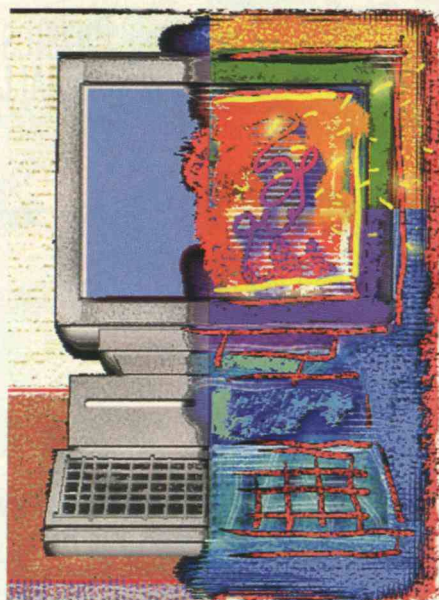
by Alluquere Rosanne Stone
MIT Press, \$19.95

BY DAVID SIMPSON

I am at heart a novelist," Alluquere Rosanne Stone informs her readers at the outset, in a statement that seems both a confession and a warning: "a shameless teller of stories." As it turns out, "shameless" is but one of a wide range of adjectives that describe this odd, baffling, annoying, brilliant, absurd, exhilarating, and deliciously provocative new book.

In *The War of Desire and Technology at the Close of the Mechanical Age*, Stone, an assistant professor at the University of Texas at Austin and director of the school's Advanced Communication Technologies Laboratory, performs the role of a roving anthropologist of the silicon world. Browsing the habitats of electronic culture, she observes exotic behavior patterns and asks, What do these bizarre customs and brave new rituals mean? What challenges, for example, do bodiless female impersonators and other fantasy projections in online chat rooms and multiuser domains pose to established concepts of gender and selfhood? Why has the Internet, to the surprise of many, emerged as more of a freeform social playground than a structured workspace?

Stone proposes that we are in the late phases of a transition between a decaying "mechanical" age and a vitally emerging "virtual" era. Today's society, she argues, remains mechanical to the extent that it still assigns "real-life" status only to the world of physical objects—that is, to material entities like human bodies and billiard balls that can be weighed on a scale and located in



Cartesian space. A truly virtual culture, on the other hand, would be one in which digital representations and purely conceptual constructions—everything from flight simulators to online aliases—would also be accepted as real.

The author goes on to suggest that as virtual culture becomes more of a presence, many of our old assumptions, especially our ideas about identity and selfhood, will be cast aside. To cite one possibility, suppose that in the future social contacts, including erotic encounters, are routinely conducted electronically. Under such circumstances, our current understanding of individual identity as something unique, stable, and securely embedded in a material body would almost certainly change. Anticipating just this development, Stone foresees a "transgendered" world—that is, one in which physical characteristics have almost nothing to do with defining personhood, and in which "multiple personality," far from being a rare psychiatric diagnosis, will become a routine part of social life.

As for the "war of desire and technology" that Stone refers to in her title, desire is her term for the spirit of exuberance and unrestricted play. Like a thrill-seeking teenager, rambunctious

and hormonal, desire seeks to obliterate boundaries and promotes whatever is fluid, random, unregulated, and unstable. Technology, on the other hand, is Stone's catchall label for the forces directed at actively subduing nature—not any particular invention or technique but rather any cultural enterprise that seeks to impose stability and order. According to this formula, freelance hackers, computer-game enthusiasts, and those who frequent the Web for social adventure are agents of desire. Meanwhile, systems engineers, lab-coated number-crunchers, and those pocket-protected, task-oriented souls who delve into cyberspace simply to garner data are servants of technology.

Rhapsodic Jargon

Although she understands the full power of the forces of technology, Stone herself expects that desire will eventually triumph in this dialectical tug-of-war. Indeed, in her view modern telecommunications and the cyber-revolution have already tilted the cultural battlefield in the direction of unboundedness and multiplicity, since they make such tendencies so difficult to keep in check. Yet before we rush off, ecstatic and free-spirited, into a cyber-Eden, it's worth recalling that the forecasts of academics like Stone have been about as reliable as those of the Psychic Friends Hotline. Only a generation ago, for example, both the French social philosopher Jacques Ellul and the American architectural critic and cultural historian Lewis Mumford were predicting, with compelling urgency, that totalitarian forces much like those Stone talks about in describing technology were in effect turning modern society into a colossal "Megamachine." By the end of the century, they warned, the last vestiges of tribal revelry and individual freedom would in all likelihood be crushed.

A recognition of Stone's true intellectual kinship does even more to put her ideas into perspective. Two figures she closely resembles are fiery literature professor Camille Paglia and Marshall

McLuhan, the founding father of modern media studies. Like Paglia, she is aggressively hip and flamboyant, a shock-artist with a flair for hyperbole and vivid metaphor. And like McLuhan, she has a capacity for bold insight and memorable, if puzzling, phrases.

Unfortunately, however, the comparison does not always wear well. In contrast with McLuhan, who was a fairly accomplished literary critic before he became a pop-culture sage, and especially Paglia, whose *Sexual Personae*, an illuminating study of the politics and aesthetics of Western gender identity, sweeps back and forth across a broad cultural landscape, Stone appears to have remarkably limited interests. Indeed, virtually every writer she cites seems to be a fellow "transgenderist" or some other like-minded contemporary academic. Also, Stone has inherited a few of Paglia's, and especially McLuhan's, worst foibles: she, too, can be an infuriating stylist, given to rhapsodic outbursts of jargon. Each new paragraph is like a lexical menagerie where rare creatures—"ontic," "reify," "ludic," and "instantiate," to name a few—roam wild.

More troubling still, Stone, unlike Paglia and McLuhan, manages to make whole passages as enigmatic as some of these individual words, and she even claims to be doing it on purpose. "In [my] seemingly haphazard and rambling style is embedded a careful and occasionally grim strategy," she confides in her final chapter, "The Gaze of the Vampire." "The purpose of this move is to open new possibilities of exchanging information at the professional level. . . ." In other words, she believes she is revitalizing the arid wasteland of academic writing. But the truth is that such attempts at revitalization have been a prominent feature of intellectual life ever since the Italian poet and self-styled "futurist" Filippo Marinetti declared death to boredom and an end to grammar, punctuation, and professors of literature in 1909. While Stone's calculated outrageousness may seem raw and racy at corporate seminars and in engineering jour-

nals, it has become a cliché in humanities departments across the country.

What is regrettable about all this is that when Stone writes unpretentiously, she can be brilliant. The questions she addresses in her anthropological quest are engrossing, and she is one of the few writers—MIT's Sherry Turkle is another—to recognize their significance. Moreover, some entire chapters of her book are subtle, clever, and hilarious. For instance, the one on the decline and fall of the Atari Research Lab is a rollicking exposé of corporate incompetence and mismanagement that ought to be mandatory reading in high-tech boardrooms. Here, for once, Stone's prose is brisk, lively, and relatively free of cant and posturing. Similarly, in a chapter entitled "In Novel Conditions: The Cross-Dressing Psychiatrist," Stone unfolds a cautionary tale of the Web—about a male psychiatrist who joins an online chat group, is mistaken for a female psychiatrist, and before long is dispensing intimate professional advice to other women. To her credit, Stone once again suppresses her usual flip, put-on style and examines the admittedly serious moral and ethical implications of this case with dark wit and genuine insight.

Reading such chapters calls to mind James Russell Lowell's assessment of another prodigal and over-clever author, Edgar Allan Poe, whose work he thought was three-fifths genius and two-fifths "sheer fudge." For although the portion of sheer fudge in *The War of Desire and Technology at the Close of the Mechanical Age* may be slightly greater than in Poe's writings, a measurable portion of genius is undeniably there. This is an enormously enjoyable and stimulating book. Alluquere Rosanne Stone is a fresh voice from the far side of techno-culture, and no doubt we can expect similarly fascinating, and irritating, performances from her in the years to come. ■

DAVID SIMPSON teaches humanities and courses in technology and culture at the School for New Learning at DePaul University in Chicago.

BOOKS

HISTORY HOLLYWOOD-STYLE

*Visions of the Past:
The Challenge of Film to Our Idea of History*
by Robert Rosenstone
Harvard University Press, \$35.00

BY BRYAN C. TAYLOR

WE commonly think of technology as the tools we design to control our environment. Less often do we think about how, as media, technologies may foster particular ways of understanding things. Yet historically, as new media have replaced the old, they have done just that, changing not only individual perceptions but even certain institutions. One famous example is the printing press, which threatened the authority of the Catholic Church. Before the mass distribution of Bibles that this technology made possible, people mainly depended on priests to interpret scripture. But as Bibles became more accessible, individual and "unofficial" interpretations by literate worshippers became more widespread. That contributed mightily to the rise of Protestantism, with its emphasis on a personal, unmediated relationship with God.

This theme of media and cultural change is central to Robert Rosenstone's *Visions of the Past*, which considers how film is influencing the way audiences see history. And as it happens, Rosenstone is in a good position to write such a book: not only is he a historian, but two of his historical works have been adapted for the screen—one a history of an American volunteer unit that fought in the Spanish Civil War, and the other a biography of the early twentieth-century radical John Reed, which inspired Warren Beatty's film *Reds*.

In discussing the issues that historical films raise, the author steers a careful



path through a contentious academic debate about the nature of history itself. Traditionally, historians have operated under the assumption that history is an objective phenomenon with facts that are reflected in various forms of evidence, such as letters, ship's logs, and other written documents. But recent critical approaches to history have challenged that assumption. The whole basis for "facts" is often questionable, this argument runs; for example, relying so heavily on written documents can mean that historians exclude the experience of illiterate groups. Moreover, no matter how strongly traditional historians may believe in their objectivity, they are still telling a story, and thus cannot help but be influenced by cultural models for how stories should be told, investing their accounts with literary conventions like

tragedy or irony. Finally, the new critics say, history, in whatever medium, is political, in that it reflects the perspective of those lucky, skillful, and powerful enough to write it.

Because, as these recent critical approaches suggest, written histories may not be true in any absolute sense anyway, Rosenstone clearly thinks that filmmakers can be granted some latitude when they take on historical subjects. He further charges that it is unfair to evaluate historical films with the criteria customarily applied to professional written history—as if film could somehow duplicate the features of that medium. The challenge for films is that they depend on specific scenes and therefore must condense the more extensive overviews provided in written history. Often filmmakers must go so far as to invent episodes and characters that propel their stories forward and heighten their dramatic impact.

Given such constraints, it is hardly surprising that historical films end up manifesting a range of characteristics that can seriously limit their quality. Rosenstone concedes that these movies tend to favor simple interpretations of events over complex ones, emphasize lavish staging and "period" looks, and engage their audience at least partly by invoking cherished beliefs, such as the idea that everything will get better and better through human ingenuity. He notes as well that historical films usually focus on heroic individuals rather than social groups, and on the emo-

tional states of characters rather than the economic and political bases of group conflict. But he adamantly resists the notion that the difficulties faced by the makers of historical films preclude good work. Indeed, he even celebrates the opportunities film creates for taking a responsible yet compelling look at the past. Not even the need to invent episodes and characters need get in the way of historical truth, he says.

True Lies

The key is that, in Rosenstone's view, not all inventions are created equal. In the film *Glory*, for instance, the characters are fictitious, but they do represent the different types of Blacks who served in Civil War regiments. Rosenstone distinguishes between such acceptable inventions and "capricious" ones like those in the film *Mississippi Burning*, which gives the impression that white FBI agents were among the principal forces in the civil rights movement. "To be taken seriously," he writes, historical films "must not violate the overall . . . meanings of what we already know of the past." And he holds up the ideal of "an existing body of historical texts" that would serve as the basis for judgments about whether particular inventions are appropriate.

It is here that Rosenstone's argument becomes slippery. Having acknowledged that all written history is rhetorical and political, he nonetheless defers to it as a source of unassailable truth. This might not have been so bad if the inventions in all historical films were as straightforwardly acceptable or capricious as those in *Glory* and *Mississippi Burning*. But the fact is that they are not.

For example, consider the film *Fat Man and Little Boy*, in which the accidental death of a Manhattan Project technician that occurred after the atomic bombs were dropped is depicted as occurring beforehand. The result is that the more cataclysmic event serves largely to intensify the emotional effect of this lowly, personal death, which might otherwise seem anticlimactic. In the judgment of most critics, that particular

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invention was a cheap, gratuitous twist: the filmmaker tragically dispatches a sympathetic character, thereby "confirming" the immorality of the Bomb.

Yet there may have been audience members who found the invention completely acceptable. For them, the doomed technician, who died of radiation exposure, may have appropriately symbolized all the nuclear weapons workers whose illnesses and deaths during the Cold War have been attributed to similar causes. Such viewers might argue that a filmmaker is justified in tinkering with history a bit to bring this grim and important reality into relief. What's needed is some way to tell precisely when and how a filmmaker's interpretation of history becomes capricious, and Rosenstone offers little help. He says, on the one hand, that there is objective information to which filmmakers must refer in constructing a historical narrative, and, on the other, that "there are an infinite number of ways to deal with our data and what it means." Thus he begs the question of whose judgments can be considered acceptable and why.

Toward the end of the book, as Rosenstone looks at "postmodern" historical films—that is, ones reflecting cultural themes of fragmentation, anxiety, cynicism, and irony—he concludes that "we do not yet know how to judge a historical work that refuses literalism as its presentational mode." Unfortunately, *Visions of the Past* cannot completely solve that problem. But after reading it we do have a sense that film technology is shaping the way we see history. We also have a sense of how ambiguous historical truth can actually be. Rosenstone encourages us to take historical film more seriously, not as a literal window on the past, but as a voice in a continuing cultural conversation about what history is and how it is produced. The value of his book is that it helps us to join that important conversation. ■

BRYAN C. TAYLOR, an associate professor of communication at the University of Colorado in Boulder, is working on a book about films and novels of the Manhattan Project.

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Phenomena

By DAVID BRITTAN

YOU TOO CAN BE A GENIUS

ONCE when I was five years old and needed cash in a hurry, I went door to door peddling paper models held together with Scotch tape and staples. An ocean liner and a locomotive, both priced at a nickel, sold well. But the item in which I had the most faith, priced at a mere two cents in anticipation of volume sales, was a little book entitled *Fun with the Family*. There was not much to it—a few slips of stapled-together paper containing precisely nothing. That's right, nothing. I had toyed with the idea of producing a conventional book, complete with words. But for various reasons, including the fact that I had not yet learned to write, I decided to leave decisions about content up to the reader. As the title implies, I thought families would have fun collaborating on stories and filling up my smudged, crooked pages themselves. I was wrong. People sensed a scam, and the book didn't sell.

I failed to realize it at the time, but *Fun with the Family* was a work of interactive fiction. It anticipated by nearly a decade the complaint of French literary theorist Roland Barthes in his 1970 book *S/Z*: "Our literature is characterized by the pitiless divorce which the literary institution maintains between the producer of the text and its user, between its owner and its consumer, between its author and its reader." The goal of literature, according to Barthes, should instead be "to make the reader no longer a consumer, but a producer of the text." In its perfect vacuity, my little book satisfied that ideal pretty well.

Computers, of course, have opened up more sophisticated

ways of dragging consumers into the creative process. A growing body of hypertext fiction, trashing the musty concept of linear narrative that dates back at least to Homer, offers the reader a swirl of story fragments that can be assembled in any number of ways. The outcome is in the hands, or more precisely the mouse-finger, of the consumer, who clicks on different options in the manner now familiar to users of CD-ROMs or the World Wide Web. Some hypertext novels even invite readers to compose their own contributions to the plot. The author is dead, long live the reader—and so goes the whole world of letters, according to many exponents of the protean, cross-referenced world of information embodied by the Internet.

"The most radical solution," writes Jay David Bolter, an electronic-media theorist at Georgia Tech, "would dispense with the notion of intentionality: there is no privileged author but simply textual networks that are always open to interpretation."

As you might expect, the grip of "intentionality" (read "something to say") is loosening in other creative fields as well. *Brain Opera*, a monumental collaborative work being mounted at New York's Lincoln Center this summer by Tod Machover, a composer at MIT's Media Lab, invites audience participation in spades. Not only has Machover solicited source material—sound clips and digital images—from the public, but ordinary people can shape each performance as it unfolds. Audience members make music at electronic sound stations—for example, the video game-like "Harmony Driver" produces

more consonant or more dissonant harmonies depending on how one travels through an onscreen landscape. Meanwhile, denizens of the Internet can modify the performance with special software.

No doubt the new age of interactive artmaking will produce some stunning successes, as well as endless opportunities for fun with the family. But like the neighbors who turned up their noses at my "interactive book," I smell a scam. Completely alien to the concept of consumer-as-writer/composer/artist is the concept of expertise. In divvying up the work of the world there is a simple wisdom in assigning tasks to those who are best

at them. When a pipe bursts, I might try to fix it myself, but I am seldom so satisfied with the result as when I call a plumber.

In its rush to be inclusive, interactive technology seems to brand as elitist the idea that persons of extraordinary gifts—literary, musical, or other—bring something of special value to the process of creation. A future literature free from the "tyranny of the author" will be just as good as the old Shakespeare-dominated one. Beethoven's Ninth Symphony would be just as viable, and a hell of a lot more democratic, with interpolations by Sid and Irma Himelfarb.

Certainly, technology makes such participation possible. You and I can now remix instrumental tracks of Peter Gabriel songs, we can navigate through "interactive art" on the Web, we can decide whether the novel's hero lives or dies. Yet I'm not sure consumers of art have been yearning for this sort of "liberation." If we had, perhaps more of us would have acquired the

skills to write novels, compose symphonies, or create sculptures. In the end, the ideal of consumer participation sounds like an academic invention. I wonder if Barthes was as worried about the "pitiless divorce" between the producer and the user when he ordered a meal in a fine restaurant. Did he long to shove aside the Cordon Bleu chef and become a participant in the creative process? Or did he, like everyone else, cede control to the person most likely to produce something edible?

Even if the new participatory artforms address a genuine need, it is questionable whether they engage people in genuine creation. The level on which consumers now exert control is many steps removed from the primal act of making art. Readers of hypertext do not think up a story but thread their way through bits of someone else's thinking: it is a tale told by a mouse. And *Brain Opera*'s success as a work of music may depend less on the talent or sensitivity of the audience-participants than on the ingenuity of those who have designed the special instruments and conceived the whole, and on the instincts of three "real" performers who, as a hedge against chaos, select and merge the streams of sound issuing from the audience. The real art in each case emanates from processes that take place in the sub-basement of a creative mind—from low-level machine code, so to speak. The consumer is simply manipulating high-level prefab modules of musical or literary thought.

I submit that my early experiment in book publishing came as close to true participatory art as any work before or since. After all, nothing captures the art of creation better than actually creating something. So if ever you turn to this page in a future issue and find it completely blank, you'll know what to do, won't you? ■



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MIT seeks a rare entrepreneur committed to entrepreneurial education to lead a successful, volunteer-driven educational enterprise into the future. The MIT Enterprise Forum promotes and strengthens the process of starting and growing companies, particularly those with a strong technology orientation, with a special emphasis on the value added by the MIT identity of the programs. The Forum seeks an Executive Director to make the Forum financially self-sufficient, while continuing to develop Forum-wide programming working with 18 Forum chairs worldwide. The Executive Director will have broad latitude to explore previously uncharted territory in the accomplishment of its mission, with several specific goals in the near term, including complete financial self-sufficiency; strong chapter involvement with their MIT home base; and development of robust corporate ties to the Enterprise Forum and the Institute.

Qualifications: The ideal candidate will have a minimum of 8 years' experience, with a strategic ability to identify growth opportunities for the Forum in both programs and sponsorships; experience and proven leadership in a respected start-up venture that has grown to a substantial level of success and visibility; with at the same time a deep appreciation for working in an academic environment; and experience and proven success in the management of volunteers.

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Qualifications: Bachelor's degree or equivalent combination of education and experience; must also have a minimum of five years' experience in database management and/or data entry in a customer-service environment. Previous supervisory experience preferred. Demonstrated ability to integrate and manage diverse systems, with the ability to learn new data handling systems. Must be able to communicate effectively, in writing and orally. Knowledge of direct mail operations and postal regulations and their implications desirable. Ability and willingness to work independently are critical.

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Must have a proven track record in many of these areas: emerging technologies and new product development; marketing services on the Internet; knowledge of the World Wide Web; working with volunteers. Other desirable qualities include excellent interpersonal, and communication skills; experience managing resources in a complex organization; demonstrated skills in motivating, developing and working with others (team building).

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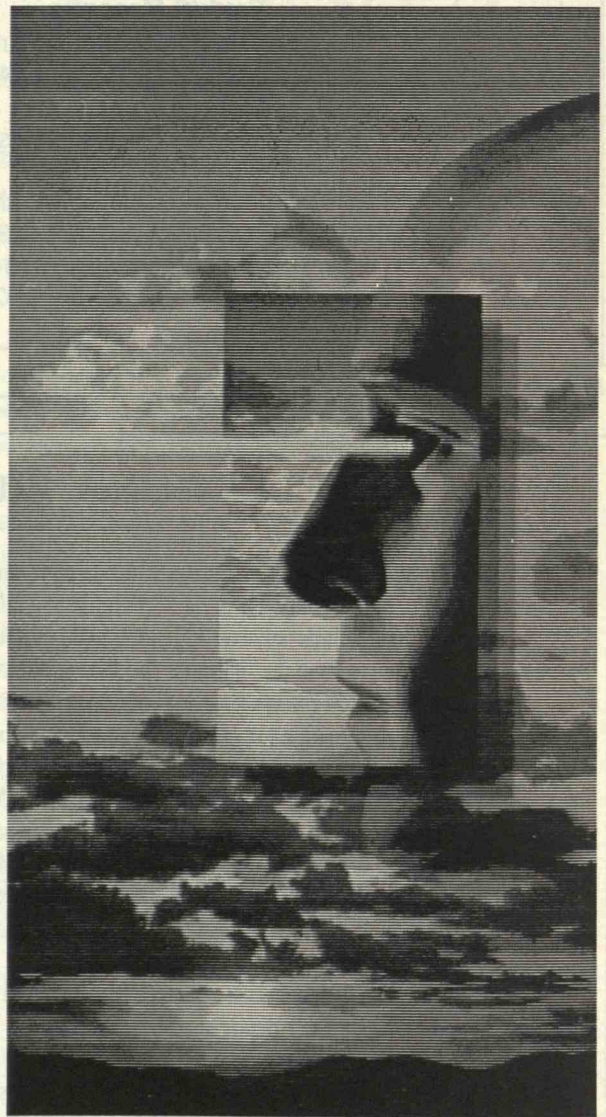
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Hot News

Employment Opportunities at BBN

How to Reach BBN



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- B.S. required; M.S. preferred.
- Familiarity with network security tools.

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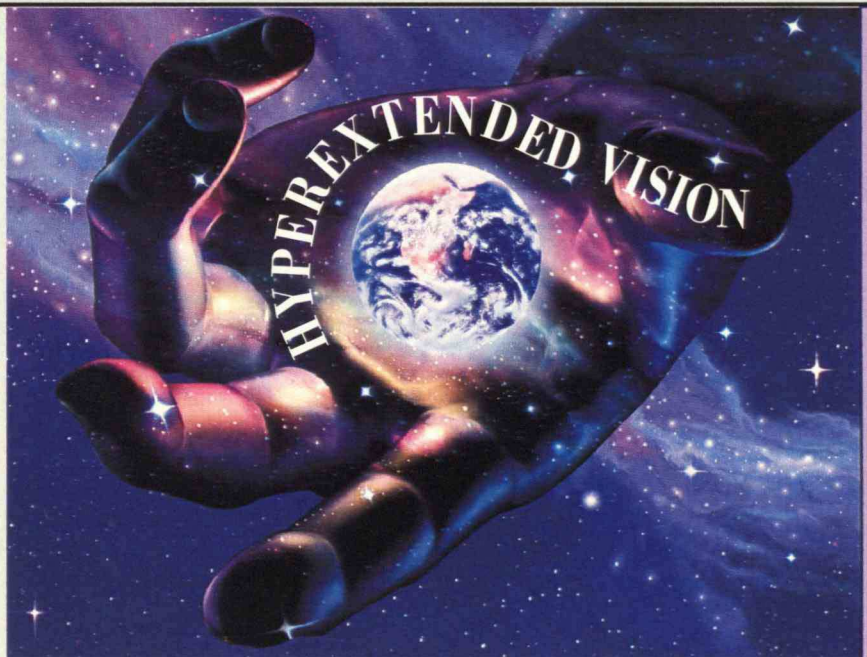
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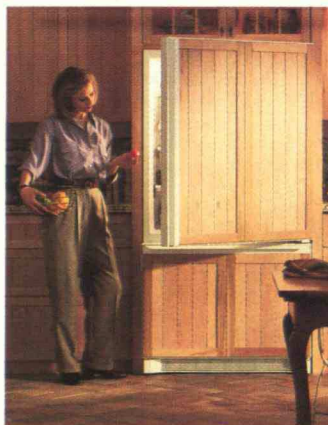
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